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OF RESEARCH ON TAXONOMY & NOMENCLATURE OF FUNGI & LICHENS

Vol. XLV October-December 1992

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THE GENUS HYMENOSCYPHUS (HELOTIALES) IN SLOVAKIA, CZECHOSLOVAKIA

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Summary

Twenty-three species of the genus *Hymenoscyphus* Nees ex S. F. Gray are reported from Slovakia, Czechoslovakia and their current taxonomic and nomenclatural status is evaluated. A synoptic key is provided for all accepted species and each species is fully described and discussed. Four species of *Helotium* were transfered to *Hymenoscyphus*: *H. callorioides* Rehm, *H. citrinicolor* P. & L. Crouan, *H. pallide-subolivaceum* Svr. and *H. tatrae* Svr. (Lizoň, 1992). *Hymenoscyphus virgultorum* (Wigg.) Phill. as an older name is proposed to be used for fungi reported previously under the name *Hymenoscyphus calyculus* (Sow. : Fr.) Phill. since the holotype of the latter species is a member of Sclerotiniaceae. Lectotype specimens are designated for *Hymenoscyphus caudatus* (P. Karst.) Dennis and *H. phyllogenon* (Rehm) O. Kuntze, and a lectotype species, *Cudonia queletii* Fr., is selected for the genus *Cudoniella* Sacc.

KEYWORDS: *Hymenoscyphus*, Helotiales, Leotiaceae, Slovakia, Czechoslovakia.

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[1] Anna E. Jenkins Visiting Fellow

Introduction

As yet there is no comprehensive monograph of Helotiales in Central Europe. Probably the first Discomycetes recorded from Slovakia (the eastern part of Czechoslovakia) were those by Scopoli, who was professor of mineralogy and metallurgy at the Mining College in Banská Štiavnica in 1760 - 1779. He reported all examined Discomycetes in the genus *Elvella* Gledisch (Scopoli, 1770). Flora Posoniensis by Lumnitzer (1791) includes 120 species of fungi and *Octospora lutescens* Hedw. [= *Hymenoscyphus lutescens* (Hedw. : Fr.) Phill.] was the first member of *Hymenoscyphus* recorded in Slovakia.

Several Discomycetes were published by Hazslinszky (1881, 1887) and Kalchbrenner (1865, 1867), two outstanding personalities of mycology in the 19th century. A monograph of Discomycetes of the Hungarian Empire by Hazslinszky (1886) reported 359 species, incl. numerous new taxa. Some data on the distribution of Discomycetes were reported also by Bäumler (1897, 1902, 1907, 1927). Many of the published data by these authors are doubtful because no authentic material of most of the reported taxa has survived.

The monograph of Bohemian Discomycetes by Velenovský (1934) was the first major taxonomic work on Discomycetes in Czechoslovakia. His collections have been preserved at PRM and PRC. Svrček (1985) reexamined these collections and evaluated the current taxonomic status of all of Velenovský's published and unpublished taxa of the genus *Helotium* (incl. *Hymenoscyphus*).

Materials and methods

The study is based mostly on examination of dried herbarium specimens. Where available fresh material collected by the author was observed. Citations for herbaria follow Holmgren & al. (1990).

Dried material was rehydrated either in distilled water, in 10 % aqueous NH_3OH, or in 2 % KOH (Kohn & Korf, 1975). Rehydrated material was initially examined by preparing a crush-mount in Melzer's reagent (Korf, 1952). Longitudinal sections were made by freezing microtome. Microscopic observations were made in Melzer's reagent, Cotton-Blue in lactic acid, Aman's lacto-phenol (Josserand, 1952), and in distilled water. Measurements were made in Melzer's reagent using a x100 oil-immersion objective. A minimum of 30 mature discharged ascospores lying free in a crush preparation were measured where available. Calculation of Mean and Standard Deviation were made of dimensions of discharged spores (Hruby, 1961). In these cases the spore measurement are presented in the form of a central tendency between bracketed extreme observed values. A K-spore quotient (length ÷ width ratio) to indicate the shape of spores is also presented. Micromorphological terms are those defined by Korf (1952, 1973).

Cultures of *Hymenoscyphus herbarum* were grown and maintained on 2 % Dextrose-Agar (Raschle, 1977; Janitor, 1977).

History: taxonomy and nomenclature

Probably the first described taxon currently referred to *Hymenoscyphus* is *Peziza virgultorum* Wiggers (1780). Dennis (1956) and many recent authors have treated this species under the name *Helotium calyculus* (Sow. : Fr.) Fr. [for nomenclature see *Hymenoscyphus virgultorum*].

Fundamental works on the taxonomy of Discomycetes, including helotioid species reported currently in the genus *Hymenoscyphus*, are the monograph by Rehm (1887 - 1896) and the compendium by Saccardo (1889). Several new species and new combinations were described in the group of helotioid Discomycetes by Karsten (1870, 1871), Fuckel (1870, 1871), Phillips (1887), Massee (1895), and Boudier (1905-1910, 1907). French Discomycetes were investigated by Grelet (1947, 1949), North American by Seaver (1951), Australian by Dennis (1958) and Spooner (1987), and Thind published some papers on Indian Discomycetes, including a short monograph on the genus *Hymenoscyphus* (Thind & Sharma, 1980). Czechoslovak Discomycetes and species of *Hymenoscyphus* and related genera were studied by Velenovský (1934, 1940, 1947) and Svrček (1953, 1958, 1959, 1960, 1962, 1975, 1977a, 1977b 1978, 1979, 1983, 1985, 1986, 1987, 1988), and Svrček & Kubička (1964).

Critical studies of helotioid species, based on type specimens and available herbarium material, were published by White (1942a, 1942b, 1943, 1944). His specimens, with numerous unpublished notes preserved at FH, were studied and are briefly discussed in this paper. The monograph of British Helotiales by Dennis (1956) is still a fundamental source for information on taxonomy, nomenclature and ecology of inoperculate Discomycetes. Later Dennis (1962, 1964) proposed to use the generic name *Hymenoscyphus* for species reported by him earlier in the genus *Helotium*. Dumont and Carpenter studied several genera and species in the families Leotiaceae and Sclerotiniaceae (Dumont, 1972, 1975, 1980, 1981a, 1981b; Dumont & Carpenter, 1982; Carpenter, 1981; Carpenter & Dumont, 1978). They located type specimens of many species and were able to evaluate the taxonomic status of those taxa. Similar methods were used by Arendholz (1979) and Baral (Baral & Krieglsteiner, 1985). Svrček (1975, 1977a, 1977b, 1978, 1979) described some new species in the genus *Hymenoscyphus*, and studied taxonomical problems in the group of helotioid Discomycetes as well.

Donk (1962) analyzed the nomenclature of *Helotium* and pointed out that it is confusing because the name has been used in two quite different senses: as *Helotium* Tode : Fr. for Agarics and *Helotium* Pers. for Discomycetes. This nomenclatural problem was later discussed by Holm (1976, 1983) and Redhead (1982). Since *Helotium* Pers. is a later illegitimate homonym of *Helotium* Tode, it must be rejected according to the International Code of Botanical Nomenclature [ICBN] (Greuter, 1988). Svrček & al. (1968)

proposed to conserve the name *Helotium* Pers. for Ascomycetes, but this proposal was not accepted. As pointed out by Dennis (1962) most of the species reported in *Helotium* "Fr." could be transferred to the genus *Hymenoscyphus* Nees ex S. F. Gray. *Hymenoscypha* Phillips is treated here merely as a orthographic variant of Gray's name. The name *Hymenoscyphi* was established by Nees (1817) for one of his 'familia' of the genus *Peziza* "Pers." Gray (1821), who raised Nees's 'familia' to generic rank, cited Nees as the author of these generic names except for *Hymenoscyphi*. This is regarded as a typographical error (Korf & Carpenter, 1974) and the generic name is cited here as *Hymenoscyphus* Nees ex S. F. Gray.

Gray (1821) placed in his genus *Hymenoscyphus* nine species, but only three of them, *H. tubaeformis*, *H. infundibuliformis*, and *H. fructigenus*, are members of the genus in its current sense. Höhnel (1918) mentioned *Helotium scutula* (Pers.) P. Karst. and *H. virgultorum* (Wigg.) P. Karst as "Typus" of *Helotium* subgen. *Hymenoscyphus*. Gray did not report either of these species and they cannot be accepted as types. Dennis (1962, 1964) designed provisionally and later formally *Peziza fructigena* Bull. as the lectotype. This species was included by Nees (1817), by Gray (1821), and also by Fries (1822), Phillips (1887), and Kuntze (1898) as well, and it is accepted by most authors in the same sense.

Related genera

Allophylaria P. Karsten, Not. Sällsk. Fauna Fl. Fenn. 11:234, 1870.
Lectotype: *Peziza subliciformis* P. Karst. (Nannfeldt, 1932).
Apothecia are minute, cupulate, light colored, ectal excipulum is composed of thick-walled cells (textura oblita), the ascus pore is dextrinoid (red in Melzer's reagent). Carpenter (1981) accepted the genus and regarded it as closely related to *Crocicreas* and *Bisporella*. The nomenclatural problem of this genus was discussed by Arendholz (1989) who preferred to keep *Allophylaria* as a distinct genus which cannot be united with *Pezizella* because of iodine-positive asci and large spores.

Antinoa Velenenovský, Monogr. Discom. Boh. 1:214, 1934.
Lectotype: *Antinoa acuum* Velen. (Baral & Krieglsteiner, 1985).
Velenovsky (l. c.) erected *Antinoa* for 8 species characterized by having black or yellowish-brown stipe. Baral (Baral & Krieglsteiner, l. c.) regarded the genus as closely related to *Calycina* with both genera referred to Hyaloscyphaceae. Svrček (1983) considered *Antinoa proximella* (P. Karst.) Velen. and *Pezizella pulchella* Fuck. to be conspecific and designated the latter as the lectotype of the genus *Pezizella*. If Svrček's designation is accepted, and *A. acuum* and *A. proximella* are congeneric, than *Antinoa* would presumably become a taxonomic synonym of *Pezizella*.

Belonioscypha Rehm, Rabenhorst's Krypt.-Fl., ed. 2, 1(3):743, 1892.
Lectotype: *Belonidium vexatum* De Not. (Clements & Shear, 1931); [= *Belo-*

nioscypha culmicola (Desm.) Dennis].
Rehm (1892) originally erected the genus for Discomycetes with marginal teeth and multiseptate spores. Carpenter and Dumont (1978) treated the genus as a taxonomic synonym of *Cyathicula*. Stadelman (1978) accepted *Belonioscypha* as a distinct genus, erroneously with the type as *Peziza culmicola*. *Belonioscypha* can be distinguished from *Hymenoscyphus* by thin agglutinated cells of the ectal excipulum and multiseptate spores.

Bisporella Saccardo, Bot. Centralbl. 18:218, 1884.
Holotype: *Bispora monilifera* Fuck.; [= *Bisporella pallescens* (Pers.) Carp. & Korf].
Apothecia are minute, turbinate to substipitate, and the ectal excipulum is composed of thin-walled glassy hyphae (textura porrecta to textura intricata). According to Carpenter (1981) *Pezizella avellanae* Lasch, one of the possible types of the genus *Pezizella*, is congeneric with *Bisporella*. If *Bisporella* is accepted in this sense, *Pezizella* as an older name is available for this genus.

Calycina Nees ex S. F. Gray, Nat. Arr. Brit. Pl. 1:669, 1821.
[≡ *Peziza* "Pers." familia *Calycinae* Nees; non *Calycina* sensu Seaver, 1934 (type: *C. firma* (Pers.) S.F.Gray = *Rutstroemia firma*)].
Lectotype: *Peziza herbarum* Pers. : Fr. (Dumont, 1972)
Apothecia are covered by distinct clavate to cylindric hairs, stipe is white, paraphyses have one large guttule, and the whole ascus apex blue in Melzer's reagent (Baral & Krieglsteiner, 1985). *Pezizella* Fuck. sensu Dennis (Baral & Krieglsteiner, l. c.) and *Helotium* b. *Calycella* Fr. (Korf & Carpenter, 1974) are reported as synonyms of this genus. The genus *Calycina* and its type species, *Peziza herbarum*, are referred here to *Hymenoscyphus*.

Conchatium Velenovský, Monogr. Discom. Boh. 1:211, 1934.
Holotype: *Conchatium bilobum* Velen.; [= *Peziza cacaliae* Pers.].
According to Svrček (1979), two genera are to be recognized: *Conchatium* Velen., without marginal apothecial teeth, and *Cyathicula* De Not., with teeth. Carpenter (1981) suggested that *Conchatium* may be placed into synonymy of *Crocicreas* Fr. *Conchatium*, as treated by Svrček (l. c.), shows relationships to Leotioideae (Ombrophiloideae) and cannot be referred to Hymenoscyphoideae.

Crocicreas Fries, Summa Veg. Scand., Sect. Post., p. 418, 1849.
Holotype: *Perisporium gramineum* Fr.
Carpenter (1981) introduced the name *Crocicreas* for fungi reported by Korf (1971), Dennis (1978) and Carpenter and Dumont (1978) in *Cyathicula* De Not. and for some species reported in *Phialea* (Fr.) Gill. The genus is characterized (Carpenter, l. c.) by white to brown apothecia, commonly with a toothed margin, cylindrical clavate or lanceolate paraphyses and agglutinated parallel hyphae of the ectal excipulum. Baral (Baral & Krieglsteiner, 1985) restricts the genus to one species, *C. gramineus* (Fr.) Fr., and its varieties, all on Poaceae, with truly lanceolate paraphyses intergrading to cylindrical, accepting *Cyathicula* for the other species placed in *Crocicreas* by Carpenter and others.

Cudoniella Saccardo, Syll. Fung. 8:41, 1889.
Lectotype: *Cudonia queletii* Fr., designated here; [? = *Cudoniella acicularis* (Bull.) J. Schröt.].
Saccardo (l. c.) erected *Cudoniella* for four species: *C. marcida*, *C. queletii* *C. stagnalis*, and *C. aquatica*. Boudier's illegal lectotypification (Boudier, 1907) by *Helvella acicularis* Bull. : Fr., a species not originally included by Saccardo in the genus, was accepted by Dennis (1964, 1978) and Baral (Baral & Krieglsteiner, 1985). No data on the identity of *Cudonia queletii* and *Cudoniella aciculare*, based on the examination of type material, has been given. Dennis (1978) treated *Cudoniella* as a distinct genus, allied to *Hymenoscyphus*, having convex disc and ascus pore not bluing in iodine. Cannon & al. (1985) accepted five species in *Cudoniella*. Baral (Baral & Krieglsteiner, l. c.) included this genus in *Hymenoscyphus* but did not transfer *C. acicularis* or *C. clavus* to the latter. Because of the clearly convex disc, a character not included in my concept of *Hymenoscypus*, I treat here *Cudoniella* as a distinct genus.

Cyathicula De Notaris, Comm. Soc. Crittog. Ital. 1:381, 1863.
Lectotype: *Peziza coronata* Bull. (Clements & Shear, 1931).
Baral (Baral & Krieglsteiner, 1985) used *Cyathicula* to include also species of the genera *Phialea* (Fr.) Gill. sensu Dennis and *Belonioscypha* Rehm sensu Stadelman. As understood by Carpenter (1981), *Cyathicula* is a synonym of *Crocicreas*.

Cystopezizella Svrček, Čes. Mykol. 37:67, 1983.
Holotype: *Pezizella conorum* Rehm.
Svrček (1983) erected *Cystopezizella* for *Pezizella conorum* and *P. conorum* var. *venceslai* Velen. and the genus was characterized by bladder-like inflated cells on the outermost layer of the excipulum. Baral (Baral & Krieglsteiner, 1985) synonymized *Cystopezizella* with *Calycina*.

Pachydisca Boudier, Bull. Soc. Mycol. France 1:112, 1885.
Holotype: *Helotium guernisacii* P. & L. Crouan
Boudier (1885) established *Pachydisca* for a single holotype species and later introduced into the genus a few additional species growing on plant debris. The genus was accepted by Nannfeldt (1932), Le Gal (1938), and Svrček (1966), who described and transferred to *Pachydisca* additional species. Dennis (1978) suggested that some *Pachydisca* species belong in *Hymenoscyphus*. Le Gal (1953) transferred the type species, *H. guernisacii*, to *Rutstroemia* P. Karst. Dumont (1972) accepted the name *Pachydisca* for *Rutstroemia* segregates and excluded the genus from Sclerotiniaceae noting the absence of stroma in the type species.

Pezizella Fuckel, Jahrb. Nass. Ver. Naturk. 23-24:299, 1870.
Lectotype: *Pezizella sordida* (Fuck.) Fuck. (Bachman, 1909).
Pezizella was erected by Fuckel (1870) for six species and the genus has been later variously interpreted. Many authors rejected the name *Pezizella* and transferred species reported in this genus to allied genera. *Pezizella vulgaris*

Fr. was incorrectly selected as lectotype by Höhnel (1926) and accepted by Dennis (1956), as both were apparently unaware of Bachman's earlier lectotypification. As pointed out by Svrček (1983), Höhnel added to the genus four species which are not congeneric with *Pezizella pulchella* Fuck. (designated by Svrček as the only possible lectotype). He noted that the name *Antinoa* Velen. is available for that species and its allies if some other lectotype were selected for *Pezizella*. As understood by him, *Pezizella* is characterized by a convex disc and in this way can be distinguished from *Hymenoscyphus* with a concave disc. Arendholz (1989) argued that the first valid typification was made by Bachman (l. c.), who designated *Pezizella sordida* (Fuck.) Fuck. as type. I accept this conclusion, Arendholz (l. c.) examined a syntype specimen of *Pezizella pulchella* and concluded it is identical with *Cistella acuum* (Alb. & Schw.) Raitv. If we accept Svrček's typification, and overthrow the earlier lectotypification by Bachman (l. c.) as not in agreement with the generic protologue, *Pezizella* becomes a synonym of *Cistella*. Baral (Baral & Krieglsteiner, 1985) considered *Pezizella* (sensu Dennis p. p.) must fall into synonymy with *Calycina*, but did not treat either *P. sordida* or *P. pulchella*.

Phaeohelotium Kanouse, Pap. Michig. Acad. Sci. Arts Lett. 20:75, 1935.
Holotype: *Phaeohelotium flavum* Kanouse.
Kanouse (1935) established *Phaeohelotium* for single type species characterized by brown spores. Dennis (1964) and Svrček (1983) introduced into the genus species with hyaline spores. The generic distinction by Svrček (l. c.) is based on characters of excipulum (composed of isodiametric thick-walled cells) and omits spore coloration. The genus is closely related to *Hymenoscyphus*, and in my treatment, is reserved only for species with brown spores.

Phialea (Fr.) Gillet, Champ. France Discom. p. 93, 1881.
Lectotype: *Peziza phiala* Vahl : Pers. (Dumont & Korf, 1977).
Dennis (1956) treated a small group of species related to *Helotium* as *Phialea* and designated *Peziza cyathoidea* Bull. (nom. rejic.) as a type. As indicated by Dumont and Korf (l. c.) the name *Phialea* must be rejected, and is so listed in the ICBN.

Generic diagnosis

Hymenoscyphus Nees ex S. F. Gray, Nat. Arrang. Brit. Pl. 1:673, 1821

≡ [*Peziza* Pers. 'familia' *Hymenoscyphi* Nees, Syst. Pilze Schwäm. p. 71, 1817; nom. illegit.]
≡ *Peziza* L. 'trib.' *Hymenoscyphae* (S. F. Gray) Fries, Syst. Mycol. 2:116-117, 1822 [valid, ICBN Art. 33.5].
≡ *Peziza* L. subg. *Hymenoscypha* (S. F. Gray) Berkeley, Smith's Engl. Fl. 5(2):200, 1826.
≡ [*Hymenoscypha* (S. F. Gray) Phillips, Brit. Discom. p. 111, 1887; an orthographic variant].
≡ *Helotium* Pers. B. *Hymenoscypha* (S. F. Gray) Rehm, Rabenhorst's Krypt.-Fl., ed. 2, 1(3):781, 1893; [non *Phialea* (Fr.) Gill. B. *Hymenoscypha*

Saccardo, Syll. Fung. 8:270, 1889].

= [*Peziza* Pers. 'familia' *Calycinae* Nees, Syst. Pilze Schwäm. p. 69, 1817; nom. illegit.]

≡ *Calycina* Nees ex S. F. Gray, Nat. Arr. Brit. Pl. 1:669, 1821; (*Peziza herbarum* Pers. : Fr., lectotype selected by Dumont, 1972).

≡ *Peziza* L. 'trib.' *Calycinae* (S. F. Gray) Fries, Syst. Mycol. 2:128, 1822 [valid, ICBN Art. 33.5].

≡ *Peziza* L. subgen. *Calycina* (S. F. Gray) Berkeley, Smith's Engl. Fl. 5(2):202, 1826.

= *Helotium* Pers. b. *Calycella* Fries, Summa Veg. Scand., Sect. Post. p. 355, 1849; (*Peziza herbarum* Pers. : Fr., lectotype selected by Höhnel, 1918).

≡ *Helotium* Pers. subgen. *Calycella* (Fr.) Saccardo, Bot. Centralbl. 18:217, 1884; [non *Helotium* subgen. *Calycella* Saccardo, Syll. Fung. 8:248, 1889 = *Calycella* (Sacc.) Saccardo in Saccardo & Sydow, Syll. Fung. 14:31, 1899].

= *Belonospora* Clements, Gen. Fungi p. 175, 1909 (holotype *Ciboria ciliato - spora* Fuck.).

Apothecia sessile to stipitate, light colored, white to yellow, only in a few species darker (greenish to purple-brownish), minute to medium. Receptacle smooth and naked, occasionally minutely downy (but lacking well differentiated hairs like those of the Hyaloscyphaceae). Disc concave, at maturity flat. Ectal excipulum forming textura porrecta - prismatica (rarely textura angularis - globulosa), composed of approximately parallel thin-walled hyphae, lying parallel or at a low angle to the surface. Medullary excipulum forming textura intricata, composed of loosely woven thin-walled hyphae. Asci cylindric-clavate, rounded or conical at the apex, usually longer than 70 µm, 8-spored, pore blue in Melzer's reagent. Paraphyses filiform, cylindrical, slender, rarely branched, hyaline, rarely pigmented, not extended, and rounded at the tip, up to 3.5 µm wide. Ascospores biseriate or uniseriate, ellipsoid to fusoid or turbinate (clavate), or slightly inequilateral, non-septate or 1-2-septate at maturity in some species, hyaline. Saprophytic on vegetable debris: on dead herbaceous stems, on fallen leaves and needles of trees and shrubs, on wood and bark of trees, on ferns and mosses; parasitic on mosses (*H. subcarneus*); never arising from a stromatal tissue.

The diagnosis presented by Gray (1821), "Thallus cuplike, thin, fibrous cellular, bald; sporidia clubshape, with sporae in each, in two rows" can not be used for the distinction of *Hymenoscyphus* from related genera. Dennis (1962, 1964) accepted *Hymenoscyphus* as a valid name for species placed mainly in *Helotium*, lectotypified the generic name, and transferred to this genus several species. His generic diagnosis (Dennis, 1978) characterizes the genus but does not separate it from related genera. He paid little attention to the neotropical species. Thind and Sharma (1980) preferred a broader concept of *Hymenoscyphus*.

Synoptic key to the species of Hymenoscyphus in Slovakia

The problem of the use of keys for identification is broadly discussed by Korf (1972) and construction of a synoptic key for species of *Hymenoscyphus* is similar to those shown by him (Korf, 1972; Korf & Zhuang, 1985b). The key includes all characters which are considered of taxonomic value. The bold face numbers indicate that species only possess a given character; those in roman face have more than one possible character state; for those in parentheses, the character state is as yet insufficiently known.

SPECIES NUMBERS OF ACCEPTED SPECIES

1. *H. callorioides*
2. *H. caudatus*
3. *H. consobrinus*
4. *H. epiphyllus*
5. *H. fagineus*
6. *H. fructigenus*
7. *H. herbarum*
8. *H. humuli*
9. *H. imberbis*
10. *H. immutabilis*
11. *H. lutescens*
12. *H. ombrophilaeformis*
13. *H. pallide-subolivaceus*
14. *H. phyllogenon*
15. *H. phyllophilus*
16. *H. repandus*
17. *H. rokebyensis*
18. *H. salicellus*
19. *H. scutulus*
20. *H. serotinus*
21. *H. subcarneus*
22. *H. tatrae*
23. *H. virgultorum*

FRUIT-BODY CHARACTERS

Color of fresh apothecia
white: 2, **5**, 7, **9**, **11**, 13, 14, **15**, **17**
± yellow: 2, 3, 4, 6, 7, 8, **10**, 13, 14, **16**, 18, 19, **20**, **22**, **23**
orange: 1, 4, 10
ochraceous: 3, 6, 7, 8, 18, 19
pinkish: **21**
dark violet: **12**
greenish: 13

Color of dry apothecia
yellowish-translucent: **21**
yellow: 2, **4**, 8, 13, 14, **15**, 17, 19, **22**
orange: 1, 10, 13
ochraceous: 2, 3, **6**, **7**, 11, 14, **16**, 18, 19, 23
brownish: 1, 3, 8, 10, 17, **20**
reddish-brown: **5**, **9**, 11, 18, 23
purplish-brown: **12**

Apothecial surface
naked: 1, **2**, 3, **4**, 5, **6**, 8, 9, 10, **11**, **13**, **14**, 15, 16, **17**, 18, 19, 21, **22**
farinaceous: 9, 10
downy: **7**, **12**, 15, 19, **20**, **23**

Stipe
absent: **1**, **4**, 5, 7, 8, **10**
short (not exceeding diameter of receptacle): 5, 7, 8, **9**, 10, **11**, **12**, 13, **14**, **15**, **17**, **18**, 21
long (as long as or longer than diameter of receptacle): 2, 3, 6, 16, 19, **20**, 21, **22**, **23**

EXCIPULUM CHARACTERS

Ectal excipulum

textura porrecta - prismatica: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23
textura angularis: 9, 10, 11, 15
textura globulosa: 4, 22

ASCUS CHARACTERS

Iodine reaction of ascus tip

blue: 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 17, 18, 19, 20, 21, 23
weakly blue: 4, 13, 15, 22

PARAPHYSIS CHARACTERS

Color

hyaline: all accepted species (except 12)
yellowish: 11, 13, 22
violet: 12

Diameter

less than 3.5 µm: all accepted species
more than 3.5 µm: 22

ASCOSPORE CHARACTERS

Shape

ellipsoid: 3, 5, 9, 11, 12, 13, 14, 15, 16, 17, 19, 22, 23
clavate: 2, 3, 13, 18, 19, 20, 21
fusoid: 1, 4, 6, 7, 8, 10, 12, 13, 15, 16, 18
turbinate: 9, 10, 17, 23

Septation

non-septate: all accepted species (except 7, 15)
1-septate: 3, 4, 6, 7, 8, 9, 11, 12, 15, 16, 17, 19

Appendages

none: all accepted species
cilia on one or both ends: 19

Length

less than 6 µm: 21
7 - 12 (13.5) µm: 1, 5, 7, 9, 10, 11, 13, 16, 20, 22
(10.5) 12 - 18 (20) µm: 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 15, 17, 20, 23
(17) 18 - 25 (26) µm: 2, 4, 6, 8, 12, 18, 19, 20, 23
more than 26 µm: 2, 19, 20

K (length ÷ width ratio)

K≤ 3: 5, 9, 10, 11, 21, 23
K= 3.1 - 4.9: 1, 2, 4, 6, 8, 10, 12, 13, 14, 15, 16, 17, 22, 23
K=5.0 - 6.9: 2, 3, 7, 8, 18, 19
K≥ 7: 20

SUBSTRATE

on bryophytes: 21
on leaves of *Cyperaceae*: 22

on herbaceous stems: 1, 3, 7, 8, 16, 19
on leaves of broad-leaved trees: 2, 4, (7), 10, 13, 14, 15, (19), (20)
on needles of conifers: 4, 13, 22
on wood and bark of broad-leaved trees: 9, 11, 12, (16), 18, 20, 23
on wood and bark of conifers: 11, 13
on fruits of broad-leaved trees: 5, 6, 9, (16), 17
on cones of conifers: (6), (11)

Accepted species

The valid name, synonyms, full description, published illustrations, habitat, general distribution and distribution in Slovakia by the orographic unit and the code of the position of the mapping squares (Jalas & Suominen, 1967), specimens examined, and notes discussing taxonomy and nomenclature of the species are presented for each species. The locality is transcribed in the original form (language); the month of collection is uniformly written in roman numerals. All interpolations in brackets, incl. the current names and explanations of localities, are by the author. The names of host plants follow Neuhäuslová & Kolbek (1982). Pfister (1985) was used for citation of exsiccatae and Pfister & al. (1990) for citation of pre-Friesian literature.

Hymenoscyphus callorioides (Rehm) Lizoň, Mycotaxon 44:321, 1992.

≡ *Helotium calloriodes* Rehm, Hedwigia 21:98, 1882.
≡ *Pezizella callorioides* (Rehm) Rehm, Rabenhorst's Krypt.-Fl., ed. 2, 1(3):676, 1892.
≡ *Calycella callorioides* (Rehm) Boudier, Icon. Mycol., Liste Prélim. p. [4], 1904.
≡ *Bisporella callorioides* (Rehm) Korf, Mycotaxon 14:1, 1982.

Apothecia bright orange when fresh, brownish-orange when dry, (0.5)1 - 2 mm diam., broadly sessile, cupulate. Disc plane to plano-concave, concolorous. Receptacle concolorous, cupulate when young, expanding and becoming flat or discoid. Ectal **excipulum** of textura porrecta, layer about 40 µm thick, composed of thin-walled hyphae, 2.5 µm diam. Medullary excipulum of textura intricata. **Asci** cylindric, apex rounded and thin-walled, pore blue in Melzer's reagent, 49-52 x 3.5-5 µm. **Paraphyses** filiform, obtuse at the apex, about 2.5 µm diam. **Ascospores** ellipsoid-fusoid, slightly tapered to the ends, non-septate, (8.5)11.0-12.5 x 1.5-2.5 µm, K= 5.0. **Anamorph** unknown.

ILLUSTRATIONS: none.
HABITAT: On herbaceous stems: *Aconitum napellus*, *A. variegatum*, *Dentaria bulbifera*.
DISTRIBUTION: ***Europe***: Austria, Czechoslovakia (Slovakia), France, Spain. **Slovakia**: Belianske Tatry Mts.: (6787) *Dentaria bulbifera*, [Tatranská kotlina] (Svrček, 1959).
SPECIMEN EXAMINED: ***Europe***: **Austria**: An faulenden *Aconitum varieg.*

beim Kartel-Gletscher (Moosthal) im Tyrol, c. 2000 m, VII.1878, Britzlmayr (S, herb. Rehm; holotype).

Hymenoscyphus callorioides is a rare species, reported only four times till now. I was not able to locate the Slovak collection by Svrček in PRM but according to his description (Svrček, l. c.) I agree with his identification. This is a distinctive species of *Hymenoscyphus* which may be readily recognized by bright yellow-orange apothecia and, according to Rehm (1882a), by hooked tips of paraphyses which I have not observed in the type specimen. Rehm (l. c.) distinguished the species from *H. herbarum* "durch den Mangel eines stielartiges Forsatzes, durch die Grösse der Sporen" in his original description. His note on a convex disc is doubtful. Grelet (1947) reported asci as not bluing in iodine.

The above description is based on the type specimen and the description of fresh collections by Rehm (1882, 1892) and Svrček (1959). It should be noted that the holotype collection consists, in addition to apothecia of *H. callorioides*, of 2-3 stipitate apothecia which are identified here with some reservation as *Hymenoscyphus repandus* (Phill.) Dennis.

Hymenoscyphus caudatus (P. Karst.) Dennis, Persoonia 3:76, 1964.

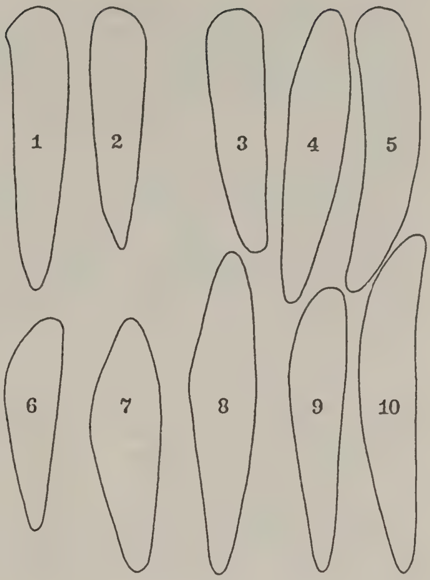
≡ *Peziza caudata* P. Karst, Fungi Fenn. Exs. no. 547, 1866.
≡ *Helotium scutula* (Pers. : Fr.) P. Karst. *** *caudatum* (P. Karst.) P. Karst., Not. Sällsk. Fauna Fl. Fenn. 11:234, 1870.
≡ *Helotium caudatum* (P. Karst.) Velenovský, Monogr. Discom. Boh. 1:206, 1934.
= *Helotium linderi* White, Farlowia 1:154, 1943.
= *Helotium naviculasporum* Ellis, Bull. Torr. Bot. Club 5:46, 1847.
≡ *Calycina naviculaspora* (Ellis) O. Kuntze, Rev. Gen. Pl. 3(2):448, 1896.
= *Helotium saprophyllum* Cooke & Peck in Peck, Ann. Rep. New York St. Mus. 29(1875):55, 1878.
≡ *Calycina saprophylla* (Cooke & Peck in Peck) O. Kuntze, Rev .Gen. Pl. 3(2):449, 1898.
= *Helotium sparsum* Boudier, Hist. Class. Discom. p. 111, 1907.

Apothecia white, to 1.5 mm diam. when fresh; yellowish to ochraceous, 0.3 - 0.5 mm when dry; long-stipitate, naked, cupulate, scattered. Disc shallow cupulate when young, expanding and becoming flat, concolorous. Stipe to 2 mm long, always longer than the diameter of the receptacle, whitish, yellowish when dry, naked. Ectal **excipulum** of textura porrecta, not clearly distinct from the medullary tissue, composed of hyaline, prismatic cells, 4-16 x 3-7 µm, innermost narrower (1 - 3 µm), longer towards the margin and the stipe. Medullary excipulum of textura intricata, composed of hyaline hyphae, 2 - 4(5) µm diam. **Asci** cylindric-clavate, apex usually conical, pore blue in Melzer's reagent, 85-105 x 8.5-9.5(11) µm. **Paraphyses** filiform, obtuse at the apex, about 2 µm diam. **Ascospores** biseriate, clavate, rounded at the proximal end, tapered toward the distal end, usually inequila-teral and curved, containing several guttules, non-septate, 18.0-25.5(27.5) x 3.2-4.5(5.5) µm, K= 5.1. **Anamorph** unknown.

ILLUSTRATIONS: Boudier (1907), Velenovsky (1934), White (1943), Dennis (1956, 1960, 1968, 1978), Dumont & Carpenter (1982); this paper.

HABITAT: On fallen leaves of broad-leaved trees and shrubs: *Acer campestre, A. negundo, Acer* sp., *Alnus glutinosa, Alnus* sp., *Aesculus hippocastaneus, Berberis repens, Berberis* sp., *Betula* sp., *Carpinus* sp., *Carya* sp., *Corylus* sp., *Fagus sylvatica, Populus tremula, Populus* sp., *Quercus* sp., *Salix* sp., *Tilia* sp.

DISTRIBUTION: ***Europe***: Czechoslovakia (Slovakia, Moravia, Bohemia), Estonia, Finland, Germany, Great Britain, Poland. ***Macaronesia***: Madeira. ***North America***: Mexico, U.S.A. ***South America***: Columbia, Ecuador, Peru, Venezuela. **Slovakia**: Nízke Tatry Mts. (7083), Vihorlat Mts. (7198).



Ascospores of *H. caudatus*: 1 - 2. FH, Mycoth. March. no. 674; 3 - 5. FH, Fungi Fenn. Exsic. no. 547, lectotype; 6. FH, Fl. Boh. Morav. Exsic. no. 236; 7. CUP 27890 , holotype of *Hel. linderi*; 8. CUP-M 276; 9 - 10. BRA, Vihorlat Mts. x2000.

SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Nízke Tatry: (7083) ad pedem montis Veľky Gápel, ad folium *Fagi sylv.*, 1600 m, 8.IX.1960, Z. Moravec (PRM 614217; Svrček, 1962); Vihorlat: (7198) ad foliam *Fagi sylv.* prope lacum Morské oko, 750 m, 3.XI.1968, P. Lizoň (BRA). **Czechoslovakia, Moravia**: Auf *Acer campestre*, M. Weisskirchen [Hranice na Moravě], Hrabuvka, 14.IX.1912, F. Petrak (FH, Petrak, Fl. Bohem. Morav. Exs. no. 236, 1912). **Finland**: Mustalia, på förmultanande aspblad, X.1865 (Karsten, Fungi Fenn.Exs. no. 547, 1866: FH, lectotype; H, isotype); Tavastia australis, Tammela, Mustalia, 4.X.1867, P. Karsten (H, herb. Karsten no. 3220). **Germany**: Auf *Acer*-Blätter im Tiergarten bei Berlin, X.1884, P. Sydow (FH, Mycoth. March. no. 677, 1884). ***Asia***: **Japan**: On petiole of ? *Carpinus*, West end of Lake Chuzenji, Nikko National Park, Trochigi Pref., Honshu, 5.X.1957, S. Imai, R. P. Korf & al. (CUP-JA 65, as *Helotium caudatum* subsp. *orientale* Korf); On leaf blade of *Acer mono*, Along north shore of Lake Marunuma, Gumma Pref., Honshu, 7.X.1957, R. P. Korf (CUP-JA 142). ***Macaronesia***: **Madeira**: On leaf blade, above Ribeiro Frio, toward Poiso, 13.I.1977, R. P. Korf, R. Fogel, G. L. Hennebert, L. M. Kohn (CUP-MM 510);

On leaf of *Persea* sp., below Ponsada Vinhaticos, 15.I.1977, R. P. Korf & al. (CUP-MM 1526); On leaf blade, above Ribeiro Frio, toward Poiso, 13.I.1977, R. P. Korf & al. (CUP-MM 1507). ***North America*: Mexico**: On leaves between Oaxaca and Puerto Angel, Oaxaca, 11.VIII.1967, K. P. Dumont (CUP-ME 169); On leaf, on road between Tuxtula Gutierrez and Villahermosa, Chiapas, 19.VIII.1967, K. P. Dumont (CUP-ME 276). **U.S.A.**: On *Carya* midribs and net veins of previous season's fallen leaves, Ithaca, N. Y., 14.IX.1938, H. H. Whetzel & W. L. White (CUP 27890, as *Helotium saprophyllum*); On fallen leaves, Chimney Trail, Great Smoky Mt. National Park, Tennessee, 3200 ft., 18.VIII.1936, D. H. Linder (FH, holotype of *Helotium linderi*); On petioles and herbaceous stems, Fall Creek, Ithaca, N. Y., 19.X.1941, H. H. Whetzel & J. Niederhausen (FH); On leaves of *Berberis repens* in litter, Idaho, Nez Perce County, 900 ft., 30.XI.1946, W. B. & V. G. Cooke (FH); On *Acer negundo*, Cornell Campus, Ithaca, N. Y., 30.VIII.1974, M. A. Sherwood (CUP 54851); On petiole and blade of fallen leaf, Glacier Nat. Pk. Mont., Swiftcurrent Lake, F. Korf & R. P. Korf (CUP 37697); On fallen petioles and herbaceous stems, Fall Creek, Varna, N. Y., 14.IX.1982, A. Bujakiewicz (CUP 59878).

The lectotype at FH has 3 pieces of a leaf (? leaves) of *Acer* and 1 piece of petiole, bearing about 5 fruit-bodies. When dry apothecia are stipitate, about 0.8 mm diam., stipe is 0.5 x 0.1-0.2 mm. Ascospores are biseriate, clavate-fusoid, non-septate, (15.3)17.0-19.0(20.7) x 3.5-4.5 µm. According to White (in litt., FH) the specimen originally consisted of about 15 apothecia. White observed larger spores (26 x 4.4, 22.7 x 4.6, 23.4 x 5.2 µm) and this indicates the isotype does not include fully mature fruit-bodies now. He pointed out the iodine reaction is restricted only to ascus pore. I here designate the specimen at FH as the lectotype of *Peziza caudata*. I have examined also the isotype at H which consists of 2 fruit-bodies on the veins of a leaf of *Populus tremula*. The specimen agrees in all aspects with the lectotype specimen at FH. Disc is orange-yellow, receptacle yellowish and stipe yellowish, brownish towards the base, about 2.5 mm long. Ascus pore blue in Melzer's reagent and spores are clavate, (17.6)19.0-21.5 x (2.9)3.5-4.5 µm. Another specimen in Karsten's herbarium (no. 3220) has similar characters to the isotype.

Slovak collections have young fruit-bodies and only a few mature spores were observed, but the specimens agree well in all characters with *H. caudatus* as understood here.

There are some folicolous stipitate species referred to *Hymenoscyphus*, *Lanzia*, and *Lambertella* which have close relationships to this species. There can be a little doubt that *H. caudatus* is closely allied to *Hymenoscyphus serotinus* and *H. scutulus*. *H. serotinus* has similar excipular structure and its ascus apex is conical (Dumont & Carpenter, 1982), and *H. scutula* has a comparable shape of spores. A collection from Columbia reported by Dumont and Carpenter (l. c.) as *Hymenoscyphus* affin. *scutulus* seems to have relationships to the present species and its spores have a similar shape and size but have a short appendage recalling *H. scutulus*.

Hymenoscypus strangulatus (Velen.) Svr. is a closely related species with 1-septate spores and *H. denticulatus* (Velen.) Svr. has slender spores (22-26 x 3-4 µm, 17-22 x 3.5-4 µm) and crenulate margin of the receptacle (Svrček, 1985). A collection of *H.* cfr. *caudatus* from China by Korf & Zhuang (1989) differs from typical *H. caudatus* in the larger apothecia, larger spores, and occurrence on roots of grass.

Dennis (1956, 1978) gave measurements for the spores of this species as typically 16-20 x 4-5 µm, but on *Corylus* he reported spores 22-25 x 3-3.5 µm and 25-30 x 2.5-3 µm. Svrček (1962) reported spores on *Salix caprea* 18.5 x 4.5 µm, on *Fagus sylvatica* 20-21 x 4 µm; White (1943) 18-25 x 4.5-5.5 µm; Benkert (1976) on *Fagus sylvatica* 20-23 x 4.5-5 µm and on *Aesculus* 21-23 x 3 µm. The measurement by Dumont and Carpenter (l. c.) as (14)16-23(26) x 4-5(6) µm are similar to those presented here.

Helotium berberidis Syd., probably a nomen nudum, was reported by Dennis (1956) as conspecific with *Hymenoscyphus caudatus*. The "isotype" of *H. berberidis* (FH, Sydow, Mycoth. March. no. 1574, 1887) has brownish spores and stromatal development. Kimbrough & Atkinson (1972) reported as *Hymenoscyphus caudatus* a collection with an anamorph of *Idriella*, also with brown spores. Both collections are probably conspecific with a collection from Japan being described as a new genus and new species of the Sclerotiniaceae (Korf, Zhuang & Lizoň, in manuscript).

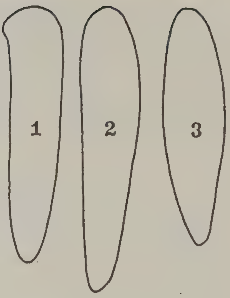
Hymenoscyphus consobrinus (Boudier) Arnolds & Baral in Baral & Krieglsteiner, Beih. Z. Mykol. 6:124, 1985.

≡ *Helotium consobrinum*, Boudier, Hist. Class. Discom. Eur. p. 114, 1907.

Apothecia deep yellow to ochraceous-yellow, brownish-yellow when rehydrated, 0.7 - 2(3) mm diam., long-stipitate, cupulate, solitary. Disc concave, deep yellow. Outer surface of the receptacle brownish-yellow when rehydrated, naked. Stipe paler, minutely downy. Ectal **excipulum** of textura porrecta, composed of cylindrical cells, 23-33 x 6.5-8.5(10) µm, toward the margin, up to 60 µm long. Medullary excipulum of textura porrecta becoming textura intricata in the centre of the receptacle, composed of hyphae about 7 µm diam. **Asci** clavate, apex conical, pore blue in Melzer's reagent, 85-95 x 6.5-7.5(9) µm. **Paraphyses** filiform, obtuse at the apex, 1.5 - 2.0 µm diam. **Ascospores** biseriate, irregular ellipsoid to clavate and tapered toward the distal end, straight or curved, 0-1-septate, (13.7)17.1-20.3(22.0) x 2.7-4.7 µm, K= 5.3. **Anamorph** unknown.

ILLUSTRATIONS: Boudier (1908); this paper.
HABITAT: On herbaceous stems: *Epilobium* sp., ? *Gentiana asclepiadea*, *Rumex acetosa*, *Rumex* sp.
DISTRIBUTION: ***Europe***: Czechoslovakia (Slovakia), France, Germany, Great Britain, The Netherlands. **Slovakia**: Nízke Tatry Mts. (7183).

SPECIMENS EXAMINED: ***Europe*: Czechoslovakia, Slovakia**: Nízke Tatry: (7183) in monte Chopok, supra "Srdiečko", ? *Gentiana asclepiadea*, 7.IX.1960, J. Kubička & M. Svrček (PRM 614219; Svrček, 1962). **The Netherlands**: Stengels (waardpl. onbekend, gras ?), "Waaltra" bij Eidhoven, VII.1953, J. Daams (CUP-G 1061).



Ascospores of *H. consobrinus*. 1 - 2. PRM 614219. 3. CUP 1061. x2000.

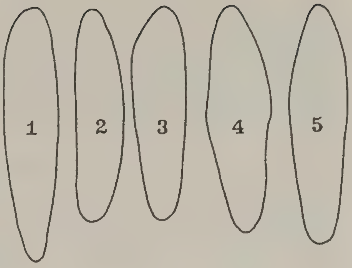
Material of the two collections cited above is conspecific with *Helotium consobrinum* as originally described but differs in having smaller spores. The specimens agree in all characters, incl. the spore size, with Dennis's (1956) description. The species seems to be allied to *H. scutula* and, according to Boudier (1907) and the material examined, *H. consobrinus* is a distinctive species recognized by its fusoid spores, lacking cilia and tapered ends, and by a whitish downy stipe, thickened at the base. The spores are reported as 16-21 x 3,3.5 µm by Dennis (l. c.) and 17-21(23) x 3.5-4 µm by Baral (Baral & Krieglsteiner, 1985), who considered its relationships to *H. fructigenus*. It is clearly a distinct member of *Hymenoscyphus*, as here understood.

Hymenoscyphus epiphyllus (Persoon : Fries) Rehm in Kauffman, Pap. Michig. Acad. Sci. Arts Lett. 9(1928):177, 1929.

≡ *Peziza epiphylla* Persoon, Tent. Disp. Meth. Fung. p. 72, 1797; Fries, Syst. Mycol. 2:137, 1822.
≡ *Helotium epiphyllum* (Pers. : Fr.) Fries, Summa Veg. Scand., Sect. Post., p. 356, 1849.
≡ *Calycina epiphylla* (Pers. : Fr.) O. Kuntze, Rev. Gen. Pl. 3(2):448, 1898.
= *Helotium agrostideum* Velen. var. *bipunctatum* Velenovský, Monogr. Discom. Boh. 1:199, 1934.
= *Helotium carpinicolum* Rehm, Hedwigia 35:146, 1896.
= *Helotium culmigenum* Velenovský, Monogr. Discom. Boh. 1:200, 1934.
= *Helotium dentatum* Velenovský, Monogr. Discom. Boh. 1:187, 1934.
= *Helotium lunatum* Velenovský p. p., Monogr. Discom. Boh. 1:189, 1934.
= *Helotium novum* Velenovský, Monogr. Discom. Boh. 1:204, 1934.
= *Helotium rubicola* Velenovský, Monogr. Discom. Boh. 1:190, 1934; [non *Helotium rubicola* (Fr.) Fuck.].

Misappl. *Helotium acicularum* (Rolland) Sacc. sensu Velenovský, Monogr. Discom. Boh. 1:197, 1934.
Helotium conformatum (P. Karst.) P. Karst. sensu Velenovský, Monogr. Discom. Boh. 1:204, 1934.

Apothecia bright yellow to orange-yellow, about 4 mm diam., subsessile. Receptacle the same color. Disc concave to flat at maturity. Ectal **excipulum** of textura porrecta and textura globulosa at the base of the receptacle, composed of prismatic cells, 12-20 x 5-7 µm, lying in rows parallel to the surface, longer toward the margin, and globose or isodiametric cells, 10 - 15 µm diam. Medullary excipulum of textura intricata, composed of hyphae, 3 µm diam. **Asci** cylindric-clavate, 90-120 x 9-12 µm, the pore outlined distinctly but not strongly blue in Melzer's reagent. **Paraphyses** filiform, occasionally branched, 2 - 3 µm diam. **Ascospores** uniseriate, fusoid, some of them pointed on one end, 0-1-septate, (12.6)15.0-18.0(18.9) x 3.5-5.0 µm, K= 3.9. **Anamorph** unknown.



Ascospores of *H. epiphyllus*: 1 - 3. PRM 614222; 4. FH - Mycoth. Germ. no. 701; 5. CUP 25511. x2000.

ILLUSTRATIONS: Rehm (1893), Durand (1900), Nannfeldt (1932), Velenovský (1934), White (1943), Le Gal (1953), Dennis (1956, 1960, 1968, 1978), Dumont (1981), Svrček (1985); this paper.
HABITAT: On fallen leaves of broad-leaved trees and shrubs: *Aesculus* sp., *Acer* sp., *Alnus glutinosa*, *Alnus* sp., *Betula pendula*, *Betula* sp., *Carpinus betulus*, *Castanea* sp., *Fagus sylvatica*, *Juglans regia*, *Populus nigra*, *P. tremula*, *Populus* sp., *Quercus ilex*, *Q. robur*, *Q. rotundifolia*, *Quercus* sp., *Rubus arcticus*, *Salix* sp., *Sorbus* sp., *Vaccinum myrtillus*. Needles of coniferous trees: *Pinus* sp., *Picea abies*.
DISTRIBUTION: ***Europe***: Austria, Czechoslovakia (Slovakia, Moravia, Bohemia), Estonia, France, Germany, Great Britain, Hungary, Poland, Romania, Russia, Slovenia, Spain. ***Asia***: China. ***Africa***: Algeria, Malgasy Republic [Madagascar], Morocco. ***North America***: Mexico, U.S.A. **Slovakia**: Nízke Tatry Mts. (7083).; Malé Karpaty Mts.: (7868) Gemsenberg [hill Kamzík near Bratislava] (Bäumler, 1897); [vicinity of Bratislava] (Bäumler, 1907); (? 7090) [*Fagus sylvatica*], Dél Szep. [Eastern Spiš] (Kalchbrenner, 1865).
SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Nízke Tatry: (7083) in monte Chopok, supra "Srdiečko", ad folia deiecta *Vaccinii myrtilli*, cca 1800 m, 7.IX.1960, J. Kubička & M. Svrček (PRM 614222; as *Helotium novum*; Svrček, 1962). **Germany**: Jungfernhaide bei Berlin, An faulendem Blättern von *Carpinus betulus*, IX.1894, Sydow (FH, Rehm, Ascomyceten no. 1157, 1896; isotype of *Helotium carpinicolum*); Ad folia putrida *Carpini betuli*, Marchia: Bredower Forst b. Nauen, X.1896, P. Sydow (FH, Rabenhorst & Winter, Fungi Europ. Extraeurop. no. 4271, 1901; as *Hel. carpinicolum*); Auf Blattern von *Fagus sylvatica* und *Quercus pendunculata* [= *Q. robur*], Brandenburg: Bredower Forst bei Nauen, 22.IX.1907, H. Sydow (FH, Sydow, Mycoth. Germ. no. 701, 1908); Faulende Blätter von *Vaccinium myrtillus* bei Königstein a/Elbe, X.1900, Krieger (FH, Rehm, Ascomyceten no. 1362, 1901). **Austria**: *Fagus*, *Carpinus*-Bl., Wiener Wald, 27.IX.1909, von Höhnel (FH, herb. von Höhnel). ***North America***: **U.S.A.**: On decaying leaves,

Amelianchier, Populus, Acer, etc., White Lake, Adirondack Mts., N. Y., 2.IX.1936, H. H. Whetzel & W. L. White (CUP 25519; FH, herb. White no. 2641); On fallen birch leaves, moist brook bed. Great Smoky Mt. National Park (Indian Gap.), Tenn., 20.VIII.1939, D. H. Linder (FH); On various leaves, Estabrook Woods, near Concord, Mass., 5.X.1974, D. H. Pfister & al. (FH).

I was not able to locate Bäumler's and Kalchbrenner's specimens from Slovakia. *Helotium novum* from Nízke Tatry Mts. collected by Kubička & Svrček has the following characters: **Apothecia** straw-yellow, about 0.3 mm diam. when dry, sessile. Outer surface of the receptacle naked. Disc concave. Ectal **excipulum** of textura porrecta, composed at the base of the receptacle of isodiametric to globose cells (textura globulosa), 4.5 - 10.5 µm diam., toward the margin of longer cylindric cells, 5.5-16 x 2-4.5 µm. Marginal cells clavate, enlarged at the apex. **Asci** clavate, the pore not blue in Melzer's reagent, 75-82 x 10-11.5 µm. **Paraphyses** filiform, with granulate contents, 2 - 2.5 µm diam. **Ascospores** biseriate, cylindric-fusoid, inequilateral, non-septate, containing 1 - 2 guttules, (13.7)14.8-17.1(18.4) x (3.0)3.4-4.0(4.2) µm, K=4.4. The fungus was reported under this name on *Vaccinum myrtillus* (Velenovský, 1934; Svrček, l. c.) and on *Carpinus betulus* (Šmarda, 1942) only from Czechoslovakia.

Apothecia of *Helotium novum* resemble those of *Hymenoscyphus epiphyllus* and there are no differences in micromorphological characters. Probably the negative reaction of the ascus pore with Melzer's reagent is caused by not using a pretreatment in KOH; when I examined the type specimen, I did not pretreat with KOH and thus cannot answer this question. Dennis reported the fungus (Svrček, 1962) as a distinct species but according to examination of holotype I agree with Svrček (1985) and I consider the name to be a synonym of *H. epiphyllus*. Svrček (l. c.) gives larger fruit-bodies (to 1 mm diam.), spores (15-19 x 4-4.5 µm), and unusually large cells of the ectal excipulum (30 x 14 µm).

Type material of *Peziza epiphylla* Pers. has not been located. Seaver (1951) examined a specimen of *Helotium epiphyllum* in Persoon's collection consisting of yellowish apothecia on leaves of *Corylus* (he did not give any microscopical data). Dumont (1981) was not able to find any apothecia in Persoon's original material. He cited this specimen as *Peziza epiphylla* "Pat." [sic], Om foliis *Popula*, L 4626 No. 2 Leid. Herb. Persoon (Dumont, in litt., NY).

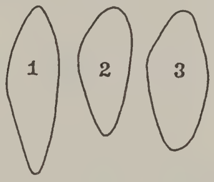
European and North American specimens studied agree in all respects with the description as presented here and with Dennis's concept of this species (Dennis, 1956). Length of the ascospores varies from 14.5 to 18 µm but I observed spores as small as 12.6 µm (FH, herb. von Höhnel) and 18.9 µm long (FH, isotype of *Hel. carpinicolum*). Ascus pore of specimens studied at CUP and FH blue in Melzer's reagent (material was pretreated with KOH). This species is characterized here as having the pore blue in Melzer's reagent and globose cells in basal part of ectal excipulum which indicate possible relationships to *Pachydisca* Le Gal.

White (1943) regarded *Helotium carpinicolum* Rehm as a distinct species having smaller ascospores (13-16 x 4-4.5 µm). Dennis (1956) reported collections also on *Carpinus betulus* having spores 17-18 x 4-5 µm, 14-16 x 3.5-4 µm, 12-15 x 3-4 µm. According to isotype characters at FH, I consider this name must fall into synonymy with *H. epiphyllus*.

Dennis (1978) referred to *Helotium sulphuratum* (Schum. : Fr.) Phill., "a scarcely distinguishable fungus on fallen needles of *Pinus*", as probably identical with *H. epiphyllus*, but Le Gal (1954) treated it as a distinct taxon.

Hymenoscyphus fagineus (Persoon : Fries) Dennis, Persoonia 3:74, 1964.
≡ *Peziza faginea* Persoon, Tent. Disp. Meth. Fung. p. 34, 1797; Fries, Syst. Mycol. 2:136, 1822.
≡ *Helotium fagineum* (Pers. : Fr.) Fries, Summa Veg. Scand., Sect. Post., p. 356, 1849.
≡ *Ombrophila faginea* (Pers. : Fr.) Boudier, Hist. Class. Discom. Eur. p. 72, 1907 (excl. descr.).
? = *Elvella fungiformis* Scopoli, Ann. Hist.-Nat. 4:150, tab. 2, fig. 8, 1770.
? ≡ *Calycina fungiformis* (Scop.) O. Kuntze, Rev. Gen. Pl. 3/2:447, 1898.

Apothecia pure white to creamy when fresh, reddish-brown when dry, 0.5 - 1 mm diam., subsessile to short-stipitate, cupulate, scattered. Receptacle white, flattened at maturity, naked. Stipe to 0.5 mm long, with a few white hyphae at the base. Ectal **excipulum** of textura porrecta, composed of cells 4 - 5 µm diam. in rows at a high angle to the surface and parallel at the margin. Terminal cells forming hair-like free elements to 20 µm long. Medullary excipulum of textura intricata, composed of hyphae 2.5 - 3 µm diam. Asci cylindric, apex rounded, pore blue in Melzer's reagent, 65-80 x 8-9 µm. **Paraphyses** filiform, slightly enlarged at the apex, 3 µm diam. **Ascospores** ellipsoid, some of them tapered towards the distal end, straight, non-septate, 8.5-12.0(16.0) x 3.6-4.2(5.0) µm, K= 2.6. **Anamorph** unknown.



Ascospores of *H. fagineus*: 1 - 2. CUP-G 1065; 3. CUP, Fungi Gal. Sel. Exsic. no. 3254. x2000.

ILLUSTRATIONS: Velenovský (1934), Dennis (1956); this paper.
HABITAT: On fallen pericarps: *Fagus sylvatica*.
DISTRIBUTION: ***Europe***: Czechoslovakia (Slovakia), Germany, Great Britain, France, The Netherlands, Switzerland. **Slovakia**: Slovenské Beskydy Mts.: (6483) *Fagus*, Wazowiec [hill Vonžovec] (Bujakiewicz, 1974).
SPECIMENS EXAMINED: ***Europe***: **France**: Sur les involucres pourrisant du Hêtre, Chausée de Pont-Point, Forêt de Hallat (Oise), XI.1884, Chartier Comm. (CUP, Roumeguère, Fungi Sel. Gall. Exsic. no. 3254, 1885). **The Netherlands**: *Fagus*, "De Donenkamp", Wageningen, 10.X.1950, J. Gremmen

(CUP-G 1065).

Hymenoscyphus fagineus is often misinterpreted in literature as pointed out by Dennis (1956). The brief original description, "minuta planiuscula albida, brevissimo crasso" (Persoon, 1797), can not be used for delimitation of the species. No recent data on a type specimen are available. The concept of the species, as presented here, is based on Dennis's description following Rehm's material.

Material from Europe (CUP) agrees with Dennis's description in all respects. The French specimen has ± sessile apothecia, reddish-brown disc when dry, spores 9.6 x 3.6-4.2 µm. The specimen from the Netherlands has short-stipitate apothecia, 0.5 - 0.8 mm diam. when dry, and spores 8.4-12 x 3.6 µm.

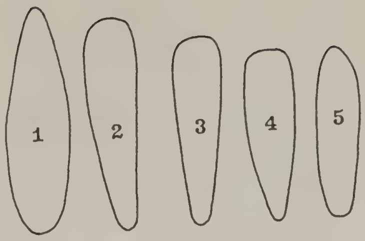
As briefly discussed by Dennis (l. c.), this species is closely related to *Hymenoscyphus fructigenus* (incl. *H. rokebyensis*) which is distinguished by having stipitate apothecia and narrower spores.

An older name, *Elvella fungiformis* Scopoli, was reported as a synonym of this species by Fries (1822) and Rehm (1893). *E. fungiformis* was described by Scopoli (1770) from Slovakia as growing on wood. Until type material can be found and examined, or a neotype specimen designated, the taxonomic status of *E. fungiformis* will remain unknown.

Schweinitz (1832) collected *Peziza faginea* Fr. on leaves in Bethlehem, Pennsylvania but it has not been re-collected in the U.S.A. recently. No comments were given by Seaver (1951).

Hymenoscyphus fructigenus (Bulliard : Fries) S. F. Gray, Nat. Arrang. Brit. Pl. 1:673, 1821.

≡ *Peziza fructigena* Bulliard, Hist. Champ. France p. 236, tab. 228, 1791; Fries, Syst. Mycol. 2:118, 1822.
≡ *Helotium fructigenum* (Bull. : Fr.) Fuckel, Jahrb. Nass. Ver. Naturk. 23-24:314, 1870.
≡ *Phialea fructigena* (Bull. : Fr.) Gillet, Champ. France Discom. p. 99, 1881.
≡ *Helotium virgultorum* var. *fructigenum* (Bull. : Fr.) Rehm, Rabenhorst's Krypt.-Fl., ed. 2, 1(3):783, 1893.
= *Peziza carpini* Batsch, Elench. Fung. p. 216, tab. 27, fig. 150, 1786; [not sanctioned by Fries, 1822].
≡ *Hymenoscyphus fructigenus* var. *carpini* (Batsch) Hengstmengel, Persoonia 12:489, 1985.
? = *Phialea fructigena* (Bull. : Fr.) Gill. f. *lignicola* Gonzales, Cong. Coimb. Cienc. Nat. Ass. Espan. 6:16, 1925.



Ascospores of *H. fructigenus*: 1. CUP 1378; 2. BRA, Moravia; 3 - 4. BP 68576; 5. FH, Pl. Crypt. France no. 1060. x2000.

Apothecia yellow or yellow-ochraceous, 1 - 3 mm diam., long-stipitate, cupulate. Disc concave to flat at maturity, ochraceous, margin incurved when dry. Stipe cylindrical, concolorous, 3-15 x 0.2-0.3 µm. Ectal **excipulum** of textura porrecta, composed of cells about 5 µm diam., generally in rows almost parallel with the surface and at low angle at the base of the receptacle. Medullary excipulum of textura intricata, composed of thin-walled hyphae, 2 - 4 µm diam. **Asci** clavate, rounded at the apex, gradually tapered below to a narrow base, pore blue in Melzer's reagent, 200 x 6-8 µm. **Paraphyses** filiform, obtuse, septate, about 2 µm diam. **Ascospores** cylindric-fusoid or slightly inequilateral, rounded at the proximal end and tapered towards the distal end, non-septate, rarely 1-septate, 12.5-17.5 x 3.2-4.0(4.5) µm, K= 4.1. **Anamorph** unknown. Berthet (1964b) reported a sterile culture producing a yellow pigment.

ILLUSTRATIONS: Bulliard (1791), Bulliard & Ventenant (1809), Gillet (1879), Boudier (1908), Velenovský (1934), Dennis (1956, 1960, 1968, 1978), Thind & Singh (1961); this paper.

HABITAT: On pericarps, acorns and nuts of broad-leaved trees: *Acer* sp., *Aesculus hippocastaneus*, *Alnus glutinosa*, *Alnus* sp., *Carpinus betulus*, *Castanea vesca*, *Corylus avellana*, *Fagus sylvatica*, *Hicoria* sp., *Juglans regia*, *Quercus* sp.. On wood and twigs of broad-leaved trees and shrubs: *Calluna vulgaris*, *Fagus sylvatica*, *Prunus* sp. On cones of conifers: *Picea abies*, *Pinus sylvestris*.

DISTRIBUTION: ***Europe***: Austria, Bulgaria, Croatia, Czechoslovakia (Slovakia, Moravia, Bohemia), Estonia, Germany, Great Britain, France, Hungary, Poland, Russia, Sweden, Switzerland. ***Asia***: China, India. ***Africa***: Morocco, Tunisia. ***North America***: U.S.A. **Slovakia**: Malé Karpaty Mts.: (7868) [*Quercus*], Gemsenberg [hill Kamzík near Bratislava] (Bäumler, 1897); (7769) [*Fagus sylvatica*], St. Georgen [Svätý Jur] (Bolla, 1858).

SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Moravia**: Slezská nížina: ad nucem *Coryli avell.* in rivo in silva prope pag. Heraltice, 4.IX.1969, P. Lizoň (BRA). **France**: En automne, sur les fruits pourris du Hêtre, du Chêne et du Noisetier; rarement ailleurs. (FH, Desmazières, Pl. Crypt. France, ed. 1, no. 1060, 1840). **Ukraine**: Kis Szlatina [Solotvinka near Užhorod], 29.VIII.1883, S. Mágoczy-Dietz (BP 68576). ***North America***: **U.S.A.**: On decaying acorn, Madison, Wis., VIII.1885, Trelease & Seymour (FH, Ellis & Everhart, North Amer. Fungi, ser. 2., no. 2048, 1888); On acorn, Cayuga Lake Basin, N. Y., Fall cr., 3.X.1894, E. J. Durand (CUP-D 1378).

Hymenoscyphus fructigenus was erected by Bulliard (1791) and originally described probably from France. This is the lectotype species of the genus

Hymenoscyphus selected by Dennis (1964) but no data on the type specimen of the species have been reported. The concept of *H. fructigenus,* as presented here, follows descriptions by Dennis (1956, 1968, 1978). Baral (Baral & Kriegelsteiner, 1985) doubts the substrate of the type collection was *Quercus* but the original illustration clearly shows an oak acorn. Carpenter (1981) studied the holotype of *Phialea fructigena* (Bull.) f. *lignicola* Gonzales at SP. No apothecia were found but he admits this form could be identical with *H. fructigenus*. Fries (1822) described *Peziza fructigena* Bull. f. *rubicola* Fr. [≡ *Helotium rubicola* (Fr.) Fuck.] as having paler apothecia and shorter stipe. Until type material is found and studied the taxonomic status of this form will remain unknown.

The collection reported by Bäumler (1897) from Bratislava was not located at BP. I studied only the Moravian collection from Czechoslovakia. It has yellow-brownish apothecia, 2.5 mm diam. and stipe 3 x 0.6 mm when dry, ascus pore blue in Melzer's reagent, fusoid-clavate, non-septate spores, 15.2-16.1 x 3.2 µm. The Ukrainian specimen agrees with Dennis's description in all respects (spores fusoid, 12.1-12.8 x 3.2 µm). The American material is characterized by having not clearly visible ascus walls, a pore only faintly outlined blue in Melzer's reagent, and spores, 16-19 x 3-3.5 µm and 16-17.5 x 4-4.5 µm, respectively. The French collection by Desmazières has ellipsoid spores, 12.6-13.5 x 2.7-4 µm. Dennis (1956) and Baral (Baral & Krieglsteiner, 1985) noted larger spores (13-21 x 3-4 µm, up to 21 µm long, respectively) than I have observed.

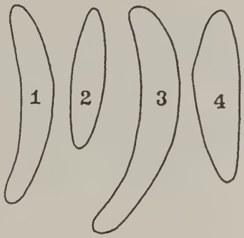
H. fructigenus is closely related to *H. fagineus* and is to be placed in the group of *H. serotinus*. It is distinguished from *H. fagineus* by larger, darker and stipitate apothecia. According to Dennis (1956), there is a form with smaller spores (10-15 x 3-4 µm) associated with pericarps of *Fagus sylvatica* but it is not possible to clearly define the limits of this taxon.

Hymenoscyphus herbarum (Persoon : Fries) Dennis, Persoonia 3:77, 1964.

≡ *Peziza herbarum* Persoon, Ann. Bot. (Usteri) 11:30, 1794; Fries, Syst. Mycol. 2:136, 1822.
≡ *Calycina herbarum* (Pers. : Fr.) S. F. Gray, Nat. Arr. Brit. Pl.. 1:669, 1821.
≡ *Helotium herbarum* (Pers. : Fr.) Fries, Summa Veg. Scand., Sect. Post., p. 356, 1849.
≡ *Malotium herbarum* (Pers. : Fr.) Velenovský, Monogr. Discom. Boh. 1:210, 1934.
= *Helotium herbarum* f. *alpestre* Rehm, Hedwigia 24:229, 1885.
= *Peziza hymenula* Fuckel, Jahrb. Nass. Ver. Naturk. 23-24:308, 1870.
≡ *Hymenoscyphus hymenulus* (Fuck.) O. Kuntze, Rev. Gen. Pl. 3(2):485, 1898.
= *Peziza rubi* var. *herbicola* Rabenhorst, Fungi Europ. Exs. no. 218, 1860.
≡ *Helotium herbicolum* (Rabenh.) Saccardo, Syll. Fung. 8:218, 1889.

≡ *Helotium herbarum* * *herbicolum* (Rabenh.) P. Karsten, Not. Sällsk. Fauna Fl. Fenn. 11:235, 1870.
= *Helotium ebuli* Velenovsky, Novit. Mycol. p. 186, 1940.

Misappl.: *Helotium doloselum* (P. Karst.) Boud. sensu Velenovsky, Monogr. Discom. Boh. 1:190, 1934.
Helotium urticae (Pers.) P. Karst. sensu Velenovsky, Monogr. Discom. Boh. 1:190, 1934.



Ascospores of *H. herbarum*: 1 - 2. BRA, Strážovské vrchy Mts.; 3. PRM 614220, holotype of *Hel. herbarum* f. *alpestre*; 4. CUP, Mycoth. Germ. no. 84. x2000.

Apothecia white, whitish to yellowish, ochraceous when dry, 0.4 - 2.5(3) mm diam., subsessile with a stipe-like tapered base or very short-stipitate, cupulate, gregarious, often occurring in swarms. Receptacle flat to discoid at maturity, whitish, minutely downy. Disc white to yellowish-white, concave to flat or slightly convex at maturity. Stipe very-short, hidden in substrate, whitish and minutely downy, 0.3-1.2 x 0.2-0.3 mm. Ectal **excipulum** of textura porrecta, composed of rectangular cells, in rows at low angle to the surface, 5-8 x 3 µm, terminating in clavate elements, to 6.5 µm diam., rising to a surface tomentum. Medullary excipulum of textura intricata to textura prismatica, composed of hyphae about 4 µm diam. **Asci** cylindric-clavate apex rounded, pore clearly blue in Melzer's reagent, 73-91 x 4.5-6(8) µm. **Paraphyses** filiform, obtuse, about 1.5 µm diam. **Ascospores** biseriate, occasionally uniseriate, fusoid to cylindric-fusoid, ends rounded, somewhat curved or inequilateral (naviculate), 1-septate (septa differentiated early in the ascus), (8.4)10.4-13.5(16.8) x (1.3)1.8-2.5(2.9) µm, K= 5.9. **Anamorph** unknown. Berthet (1964a, 1964b) obtained conidia but he reports no name for this stage. Rehm (1893) supposed *Hymenula vulgaris* Fr. and *H. ebuli* Corda to be the anamorph of *Hymenoscyphus herbarum*, but this has not been confirmed.

ILLUSTRATIONS: Boudier (1907), Gillet (1879), Rehm (1893), Velenovsky (1934), Dennis (1956, 1960, 1968, 1978), Breitenbach & Kränzlin (1981), Svrček (1985); this paper.
HABITAT: On dead herbaceous stems: *Aconitum napellus, Adenostyles alliariae, Aegopodium podagraria, Anthriscus sylvestris, Arctium* sp., *Artemisia vulgaris, Aster* cult., *Atropa belladona, Ballota hirsuta, B. nigra, Brassica napus, B. oleracea, Chamenerion angustifolium, Cirsium* sp., *Conyza canadense, Dahlia rosea, Delphinium* sp., *Digitalis ambigua, Epilobium hirsutum, Eupatorium cannabinum, Eupatorium* sp., *Filipendula ulmaria, Galium* sp., *Helianthus annus, H. tuberosus, Heracleum spondylium, Heracleum* sp., *Hypericum* sp., *Impatiens* sp., *Leonurus marrubiastrum, Libanotis pyrenaica, Lunaria redidiva, Lythrum salicaria, Mellisa officinalis, Mentha* sp., *Oenothera biennis, Rheum* sp., *Reynoutria japonica, Rubus corylifolius, R. idaeus, Rubus* sp.,

Rumex sp., *Salvia pratensisis*, *Salvia* sp., *Sambucus ebulus*, *Sambucus* sp., *Scrophularia nodosa*, *Senecio nemorensis*, *Solanum dulcamara*, *S. tuberosum*, *Solidago canadensis*, *S. virgaurea*, *Solidago* sp., *Stachys recta*, *Tanacetum vulgare*, *Urtica dioica*, *Urtica* sp., *Vincetoxicum hirundinaria*. On petioles of leaves of broad-leaved trees: *Aesculus* sp., *Fraxinus* sp., *Vitis vinifera*.
DISTRIBUTION: ***Europe***: Austria, Czechoslovakia (Slovakia, Bohemia), Estonia, Finland, France, Germany, Great Britain, Hungary, Poland, Russia, Switzerland. ***Asia***: China. ***North America***: U.S.A. **Slovakia**: Nízke Tatry Mts. (7083, 7182), Vysoké Tatry Mts., Strážovské vrchy Mts. (7076), Biele Karpaty Mts. (7172); Malé Karpaty Mts.: (7868) im Gebirge [Bratislava, in the mountains] (Bäumler, 1898, 1927); Hornádska kotlina Basin: (7089) Igló [Spišská Nová Ves] (Hazslinszky, 1886; as *Peziza hymenula*); Déli Szep., Sáros [Eastern Spiš and Šariš] (Kalchbrenner, 1865).
SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Nízke Tatry: (7083) in valle Trangoška, ad pedem montis Veľký Gápel, solo calcareo, *Delphinium* sp., 1600 m, 8.IX.1960, M. Svrček (PRM 614220; Svrček, 1962); Nízke Tatry: (7182) in caulibus emort. (? *Dauacaceae*), in convalle prope pag. Pohronský Bukovec, 4.VIII.1976, P. Lizoň (BRA); Vysoké Tatry: An faulenden Stengeln von *Aconitum napellus* L., Mengusdorfer Thal [Mengusovská dolina], VIII.1884, Linhart (H, Rehm, Ascomyceten no. 809, 1885; isotype of *Helotium herbarum* f. *alpestre*); Strážovské vrchy: (7076) in caulibus arrid. *Sambuci ebuli* in valle rivi Dobovsek ad pedem mont. Strážov prope pag. Pružina - Predhorie, 20.X.1982, P. Lizoň (BRA); in caulibus arrid. *Eupatorii cannab.* in valle rivi Dobovsek ad pedem mont. Sokolie prope pag. Pružina - Predhorie, 20.X.1982, P. Lizoň (BRA); Biele Karpaty: (7172) in caulibus arrid. *Leonuri marrub.* in humentia in clivo austr. coll. Nová hora prope pag. Moravské Lieskové - Šance, 17.X.1982, P. Lizoň (BRA); ibidem, in caulibus arrid. in prato, cca 450 m, 16.X.1982, P. Lizoň (BRA). **Czechoslovakia, Bohemia**: In *Urticae* caulibus viceis prope Reichenberg in Bohemia [Liberec], W. Siegmund (CUP, Rabenhorst, Fungi Europ. Exsic. no. 810, 1865). **Finland**, Satakunta, Tyrvis (Tyrvää), ad *Urticam dioicam*, 15.IX.1859, P. Karsten (H, herb. Karsten no. 3221); Tavastia australis, Tammela, Mustalia, ad *Epilobium*, 9.X.1868, P. Karsten (H, herb. Karsten no. 3219). **Germany**: Auf Zweigen von *Rubus idaeus*, Sachsen: Bielgrund bei Königstein a. Elbe, 29.VIII.1903, H. & P. Sydow (CUP, Sydow, Mycoth. Germ. no. 84, 1903); Brandenburg: Triglitz in der Prignitz, 8.X.1914, O. Jaap (H, Jaap, Fungi Sel. Exsic. no. 805c, 1917).

Hymenoscyphus herbarum has been collected on a wide range of hosts. Fruitbodies are numerous on the substrate but not all of them are fully mature and bear all assessed characters and this causes many misidentifications.

Dumont (1972) selected *Peziza herbarum* Pers. as the lectotype of *Calycina* Nees ex S. F. Gray and pointed out that "*Calycina* S. F. Gray" was mistypified by Seaver (1951), who chose *Peziza firma* as type, not one of Nees's original species. *Peziza herbarum* is considered to be congeneric with some of the Dennis's species of *Pezizella* by Baral (Baral & Krieglsteiner, 1985) and *Calycina* is proposed as an eligible name for them. According to the tomentose-downy clothing of receptacle and conspicuous reaction of acus pore with Melzer's reagent. Baral refers these species and the genus *Calycina* to Hyaloscyphacae. As understood here, the hairs are not those as in Hyaloscyphaceae and *Peziza herbarum* is treated in *Hymenoscyphus*, Leotiaceae.

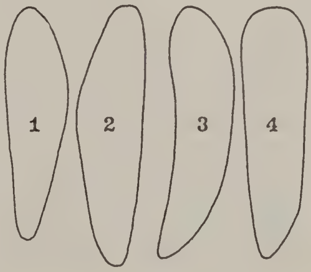
Dennis (1958) described var. *eucalypti* Dennis on the leaves of *Eucalyptus* from Australia. The variety is distinguished from European material by the darker, more gray-brown, short-stipitate apothecia.

Since no anamorphs have been obtained in pure culture only mycelial characters were observed. Initially isolates produced white sparse mycelium, becoming darker in the center and producing grey pigment. Hyphae were hyaline, sparsely septate, 1.5 - 2.5 µm diam. (8 days old). Later (23 days of cultivation) the mycelium developed several septa (at a distance of 9.5 - 38 µm). Hyphae in old cultures (54 days old) become grey-blackish pigmented, 3.5 - 5.5 µm diam.

Hymenoscyphus humuli (Lasch in Rabenhorst) Dennis, Persoonia 3:77, 1964.

≡ *Peziza humuli* Lasch in Rabenhorst, Klotzschii Herb. Mycol. no. 630, 1845.
≡ *Helotium humuli* (Lasch in Rabenh.) De Notaris, Comm. Soc. Crittog. Ital. 1:379, 1864.
≡ *Calycina humuli* (Lasch in Rabenh.) O. Kuntze, Rev. Gen. Pl. 3(2):448, 1898.
≡ *Calycella humuli* (Lasch in Rabenh.) Boudier, Hist. Class. Discom. Eur. p. 96, 1907.

Apothecia ochre-yellowish, yellow-brownish when dry, 0.1 - 1.2 mm diam., subsessile to short-stipitate, cupulate, gregarious. Receptacle concolorous, naked. Disc concolorous, plane to slightly convex when mature. Stipe 0.2-0.3 x 0.1 mm. Ectal **excipulum** of textura porrecta, composed of cells, 10-17 x 3-4 µm, terminating in clavate free elements. Medullary excipulum of textura porrecta to textura angularis, composed of almost isodiametric, angular cells, 4.5-8.5 x 4-6 µm. **Asci** clavate, rounded at the apex, pore blue in Melzer's reagent, 65-85 x 8.5-12 µm. **Paraphyses** filiform, obtuse, 3 µm diam. **Ascospores** biseriate, cylindric-fusoid, usually inequilateral, straight or slightly curved, non-septate, sometimes 1-septate, (15.8)17.6-19.5(21.0) x (3.2)3.4-4.1(4.2) µm, K= 4.9. **Anamorph** unknown.



Ascospores of *H. humuli*: 1 - 2. BRA, Hornádska kotlina Bas.; 3 - 4. CUP, Mycoth. Germ. no. 508. x2000.

ILLUSTRATIONS: Velenovský (1934), Dennis (1956), Svrček (1985); this paper.
HABITAT: On herbaceous stems: [probably only] *Humulus lupulus*.
DISTRIBUTION: ***Europe***: Czechoslovakia (Slovakia, Bohemia), Germany. **Slovakia**: Košická kotlina Basin (6993), Hornádska kotlina Basin (7089); Podunajská nížina Lowland: (7868) Au [Bratislava - Petržalka], *Humulus* (Bäumler, 1879).
SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Hornádska kotlina: (7089) Igló [Spišská Nová Ves, on stems of *Humulus lupulus*], VIII., F. Hazslinszky (BP 68531; Hazslinszky, 1886); Košická kotlina: (6993) Eperjes [Prešov], in *Humulo*, VIII, F. Hazslinszky (BP 68530). **Germany**: Auf dürren Ranken von *Humulus lupulus*. Brandenburg "Weidman's Loch" bei Tamsel, 15.IX.1905, P. Vogel (CUP, Sydow, Mycoth. Germ. no. 508, 1906).

I have not examined type material of *Peziza humuli* but according to published data and characters of the specimens studied, I accept its placement in *Hymenoscyphus* by Dennis (1964). Dennis (1956) studied only a specimen from Germany (Rehm, Ascomyceten no. 60, 1871) and placed the species into the group of *Hymenoscyphus herbarum*. Rehm (1893) distinguished the species from *H. virgultorum* by small subsessile apothecia but these two taxa can not be treated as closely related.

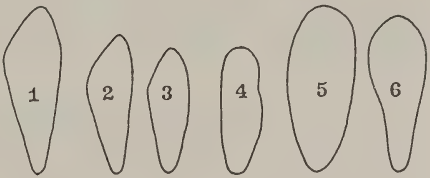
Velenovský (1934) and Benkert (1978) reported ascospores longer (to 25 µm and 21-22 µm), and Benkert pointed out that the spores were not fully mature. Collections by Hazslinszky at BP each have 10-30 fruitbodies but not all of them are mature. Only about half of the asci are mature, and fully developed apothecia may have larger spores. Rehm (l. c.) reported spores 15-20 x 4 µm and Dennis (1956) 14-17 x 3.5-4 µm, respectively. The German collection (CUP) has spores 16.8-21.6 x 3.6-4.2 µm. Hazslinszky (1886) reported apothecia having a stem as long as the receptacle diameter but examination of his collections at BP showed that his data are erroneous.

Hymenoscyphus humuli is probably associated exclusively with *Humulus lupulus*. Hazslinszky (l. c.) and Velenovsky (l. c.) consider this species to be common in Czechoslovakia but I was able to find only the specimens studied, and only a few collections have been published. The species has not been found in Great Britain (apparently erroneously listed by Cannon & al., 1985, based on European collections) and Massee (1895) studied only continental material. Clark (1980) cited a collection on *Centaurea* stems in South Herefordshire from an unpublished survey by Graddon but I am not sure if it the same species as presented here.

Hymenoscyphus imberbis (Bulliard : Fries) Dennis, Persoonia 3:75, 1964.

≡ [*Peziza nivea* Batsch, Elench. Fung. p. 117, 1786; non *Peziza nivea* (Hedw. : Fr.) Fries, Syst. Mycol. 2:90, 1822.]
≡ *Peziza imberbis* Bulliard, Hist. Champ. France p. 339, tab. 445/1, 1791; Fries, Syst. Mycol. 2:136, 1822.

≡ *Helotium imberbe* (Bull. : Fr.) Fries, Summa Veg. Scand., Sect. Post., p. 356, 1849.
≡ *Calycina imberbis* (Bull. : Fr.) O. Kuntze, Rev. Gen. Pl. 3(2):228, 1898.
≡ *Ombrophila imberbis* (Bull. : Fr.) Boudier, Hist. Class. Discom. Eur. p. 92, 1907.
≡ *Phaeohelotium imberbe* (Bull. : Fr.) Svrček, Sborn. Nár. Muz. Praha 40B(1984):152, 1985.
= *Helotium obliquum* Velenovský, Monogr. Discom. Boh. 1:407, 1934.



Ascospores of *H. imberbis*: 1. BRA, Biele Karpaty Mts.; 2 - 3. BRA, Strážovské vrchy Mts.; 4. CUP, Mycoth. Germ. no. 602; 5 - 6. CUP-MM 2162. x2000.

Apothecia whitish when fresh, reddish-brown when dry, 0.5 - 2 mm diam., short-stipitate, cupulate. Disc concave, sometimes becoming flat at maturity. Outer surface of the receptacle usually darker, naked or indistinctly farinaceous. Stipe cylindric, shorter than receptacle diameter, 0.5-1 x 0.3-0.4 mm. Ectal **excipulum** of textura porrecta to textura angularis, composed of nearly isodiametric cells, 10-20 x 5-10 µm; some of the surface cells terminating in free tips. Medullary excipulum of textura intricata, composed of thicker-walled hyphae, about 3 µm diam. **Asci** cylindric, rounded at the apex, pore blue in Melzer's reagent, 65-85(110) x 5-7.5 µm. **Paraphyses** filiform, apex obtuse, 1.5 - 3 µm diam. **Ascospores** uniseriate, ellipsoid-fusoid to turbinate, non-septate or 1-septate, with several guttules, (8.2)9.0-11.8(15.8) x (2.0)3.0-4.0(5.1) µm, K= 3,0. **Anamorph** unknown. Berthet (1964b) reported greyish mycelium in pure culture which did not produce any spores.

ILLUSTRATIONS: Bulliard (1791), Bulliard & Ventenant (1809), Dennis (1956); this paper.
HABITAT: On twigs and trunks of broad-leaved trees and shrubs: *Alnus glutinosa*, *Alnus* sp., *Corylus* sp., *Fagus sylvatica*, *Quercus petraea*, *Sambucus* sp.
DISTRIBUTION: ***Europe***: Austria, Czechoslovakia (Slovakia, Moravia, Bohemia), Germany, Great Britain, Hungary, Romania, Russia, Spain. ***Asia***: India. **Slovakia**: Slovenský kras Mts. (7390), Malé Karpaty Mts. (7669, 7768), Považský Inovec Mts. (7274), Strážovské vrchy Mts. (7076), Veľká Fatra Mts. (6981), Biele Karpaty Mts. (7173).
SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Slovenský kras: (7390) ad ramum *Fagi sylv.* in clivo mont. Krásna skala prope pag. Kováčová, 500-700 m, 9.X.1968, P. Lizoň (BRA); Malé Karpaty: (7669) ad lignum *Fagi sylv,* in clivo orient. mont. Baba (646 m) prope oppid. Modra - Piesok, 550 m, 11.V.1067, P. Lizoň (BRA; Lizoň, 1972); (7768) ad ramum *Fagi sylv.* in rivo in clivo austr. cotae 460 prope urbem Bratislava - Rača, 350 m, 25.IX.1967, P. Lizoň (BRA; Lizoň, 1972); Považský Inovec: (7274) ad ramum *Fagi sylv.* in clivo sept.-occid. mont. Inovec prope pag. Mníchova Lehota, 500-900 m,

30.IX.1967, P. Lizoň (BRA; Lizoň, 1972); Strážovské vrchy: (7076) ad ramos *Fagi sylv.* in rivo in convalle sept. mont. Cierny vrch (1079 m) haud procul a pago Pružina - Predhorie, cca 750 m, 7.VI.1968, P. Lizoň (BRA; Lizoň, 1970); Veľká Fatra: (6981) ad ramum *Fagi sylv.* in clivo orient. mont. Salatínske Žiare (cota 13100 prope oppid. Ľubochňa, cca 1000 m, 9.X.1967, P. Lizoň (BRA; Lizoň, 1972); Biele Karpaty: (7173) ad lignum arb. frond. (? *Fagus*) in rivo in convalle prope pag. Drietoma, 21.VI.1981, P. Lizoň (BRA).

Hymenoscyphus imberbis prefers wet localities and often grows on twigs immersed in a stream. I observed many apothecia in my collections. The species appears to be common, but I located only a few specimens in herbaria.

Baral (Baral & Krieglsteiner, 1985) placed this species in relationship with *Hymenoscyphus vernus* (Boud.) Dennis and *Helotium uliginosum* var. *cortisedum* P. Karst. All three taxa have similar shapes and sizes of spores, farinaceous to minutely downy receptacles, and similar structure of the ectal excipulum. The Slovak material has an excipulum formed of a tissue close to textura angularis.

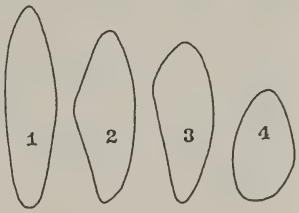
The German collection of "*Helotium imberbe* (Bull.) Fr." on *Quercus sessiflora* (CUP, Sydow, Mycoth. Germ. no. 602, 1907). consists of several well-preserved golden-yellow apothecia (not turned to reddish-brown when dry). The spores are ellipsoid, non-septate but slightly contracted medially, 8,4 x 2,4 µm. The specimen clearly represents a distinct taxon, from *Hymenoscyphus imberbis* as understood here. A Macaronesian collection labeled as *Hymenoscyphus* cf. *imberbis* (CUP-MM 2162) includes both a Basidiomycete (basidia and cystidia examined) and a Discomycete with clavate, non-septate spores 10,8 x 4,2 µm which is not conspecific with *H. imberbis*, as understood here.

According to Baral (Baral & Krieglsteiner, l. c.) *H. imberbis*, *H. fagineus*, *H. immutabile* and *Phaeohelotium geogenum* (Cooke) Svr. & Matheis are congeneric and are members of his "group" *Cudoniella* in *Hymenoscyphus*. This group is characterized by having eggutulate spores but I have examined guttulate spores in Slovak collections. Svrček (1985) transferred *H. imberbis* to *Phaeohelotium* following his broad concept of that genus.

Even though *Peziza imberbis* as reported by Bulliard (1791) on page 245 (tab. 467, fig. 2) is a superfluous name for *Pezixa nivea* Batsch (Petersen, 1977), Fries (1822) sanctioned the name. *Hymenoscyphus imberbis* is reported from the U.S.A. by Schweinitz (1832) from Pennsylvania, and by Farr & al. (1989), based on Wisconsin and Michigan collections, the identity of which is doubtful (Seaver, 1951).

Hymenoscyphus immutabilis (Fuckel) Dennis, Persoonia 3:76, 1964.

≡ *Helotium immutabile* Fuckel, Jahrb. Nass. Ver. Naturk. 25-26:50, 1871; Fungi Rhenani no. 2388, 1871.
≡ *Pachydisca immutabilis* (Fuck.) Boudier, Hist. Class. Discom. Eur. p. 94, 1907.
= *Helotium trapezoideum* Velenovský, Monogr. Discom. Boh. 1:207, 1034.



Ascospores of *H. immutabilis*: 1 - 2. BRA, Malé Karpaty Mts.; 3. PRM 614221; 4. CUP-JA 201. x2000.

Apothecia light yellow when fresh, bright yellow-orange to brownish-yellow when dry, 1 - 2 mm diam., very short-stipitate to subsessile, cupulate. Disc concave or nearly plane, bright yellow-orange. Outer surface of the receptacle paler when dry, slightly farinaceous. Stipe imperceptible, only 0.5 x 0.2 mm. Ectal **excipulum** of textura porrecta to textura angularis (at the base of the receptacle and in the stipe), composed of elongated cells, 15 x 5 µm or isodiametric cells, 10 - 15 µm diam. Medullary excipulum of textura intricata, composed of short cells, about 3 µm diam. **Asci** clavate, apex rounded, pore blue in Melzer's reagent, 75-90(105) x (5)8-10 µm. **Paraphyses** filiform, obtuse at the apex, about 2.5 µm diam. **Ascospores** biseriate, fusoid to turbinate, non-septate, eguttulate, (10.5)11.4-13.2(14.0) x (3.0)3.2-4.0(4.7) µm, K= 3.4. **Anamorph** unknown.

ILLUSTRATIONS: Dennis (1956), White (1943), Arendholz (1979), Dumont (1981), Breitenbach & Kränzlin (1981), Chmiel (1982), Svrček (1985); this paper.
HABITAT: On leaves and petioles of broad-leaved trees: *Alnus incana, Betula* sp., *Carpinus betulus, Fagus sylvatica, Populus nigra, P. tremula, Populus* sp., *Quercus robur, Q. pyrenaica, Quercus* sp., *Robinia pseudacacia, Salix capraea, Ulmus minor, Ulmus* sp.
DISTRIBUTION: ***Europe***: Bulgaria, Czechoslovakia (Slovakia, Bohemia), France, Germany, Great Britain, Poland, Spain, Switzerland. ***Asia***: China, Japan. ***North America***: U.S.A. **Slovakia**: Malé Karpaty Mts. (7083), Nízke Tatry Mts. (7083).
SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Malé Karpaty: (7768) ad folia *Fagi sylv.* in clivo mont. Tri bresty prope urbem Bratislava - Rača, 300-400 m, 20.X.1968, P. Lizoň (BRA); Nízke Tatry: (7083) ad pedem montis Veľký Gápel, solo calc., ad folia *Salicis caprae*, 1600 m, 8.IX.1960, J. Kubička (PRM 614221). **Germany**: ad *Populi tremulae* folia putrida, autumno, Boss pr. Eberbach (NY, Fuckel, Fungi Rhenani no. 2388, 1871, lectotype; FH, herb. Barley-Boissier no.1215, isotype; FH, bound set of Fungi Rhenani, isotype); Ad *Populi tremulae* folia. Boss. bei Eberbach. Oestrich (Nassau), Fuckel (FH, herb. Fuckel no. 1894). ***Asia***: **Japan**: On blade and veins of skeletonized leaf. Kurayama Hill, Kyoto, Kyoto Pref., Honshu, 23.X.1957, S. Imai & al. (CUP-JA 201).

Both isotype specimens of Fuckel's collection at FH (Herb. Barley-Boissier and bound set) agree with the lectotype specimen (labeled as a holotype) at NY in all respects. The unbound set of Fungi Rhenani at FH is incomplete and no. 2388 is missing. Asci of the isotype (FH, herb. Barbey-Boissier) are 60-70 x 4-6 µm, spores are fusoid, 8.6-10.3 x 2.7-3.4 µm. White (in litt., FH; based presumably on the bound set) reported asci 91-100 x 11.5-12.5 µm and spores 11.7-13 x 5.2-5.8 µm. Baral (Baral & Krieglsteiner, 1985) reports paraphyses as black-red in iodine but I have not observed such a reaction.

This species was considered by Rehm (1893) to be synonymous with *Helotium conformatum* (P. Karst.) P. Karst., but that is a member of the Sclerotiniaceae (Dennis 1956). Moser (1963) treated *Helotium carpinicolum* Rehm as a synonym of *Hymenoscyphus immutabilis*. I have examined an isotype of *H. carpinicolum* which is clearly conspecific with *Hymenoscyphus epiphyllus*.

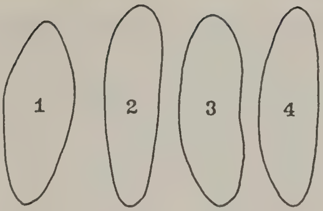
A Japanese collection labeled by Korf as a new form of *Helotium immutabile* (CUP- JA 201) is probably identical with *Hymenoscyphus immutabilis* but the spores are ellipsoid to ovoid (not fusoid), 7,2-8,4 x 4,0 µm.

Hymenoscyphus lutescens (Hedwig : Fries) Phillips, Brit. Discom. p.131, 1887.

≡ *Octospora lutescens* Hedwig, Descr. Musc. Frond. 2:31, 1789; Fries, Syst. Mycol. 2:120, 1822.
≡ *Peziza lutescens* (Hedw. : Fr.) Fries, Syst. Mycol. 2:120, 1822; [non *Peziza lutescens* Albertini & Schweinitz, Consp. Fung. p. 334, 1805].
≡ *Helotium lutescens* (Hedw. : Fr.) Fries, Summa Veg. Scand., Sect. Post. p. 355, 1849.
≡ *Phialea lutescens* (Hedw. : Fr.) Gillet, Champ. France Discom. p. 157, 1883.
≡ *Calycina lutescens* (Hedw. : Fr.) O. Kuntze, Rev. Gen. Pl. 3(2):448, 1898.
= *Helotium sazavae* Velenovský, Monogr. Discom. Boh. 1:197, 1934.
≡ *Hymenoscyphus sazavae* (Velen.) Svrček, Sborn. Nár. Muz. Praha 40B:176, 1985.

Misappl. *Helotium conigenum* (Pers.) Fr. sensu Sydow, Mycoth. Germ. no. 395, 1905.

Apothecia white, ochraceous to reddish-brownish when dry, 0.5 - 1.5 mm diam., short-stipitate. Disc nearly plane at maturity, reddish-brown when dry. Receptacle cupulate when young, becoming flat, outer surface naked. Stipe cylindric, up to 1 x 0.5 mm. Ectal **excipulum** of textura porrecta to textura angularis, composed of large, nearly isodiametric cells, 18 x (6)-12 µm. Medullary excipulum of textura intricata, composed of hyphae about 2.5 µm diam. **Asci** cylindric, apex rounded, pore blue in Melzer's reagent, 70-90 x 7 µm. **Paraphyses** filiform, filled with yellowish guttules, about 2 µm diam. **Ascospores** uniseriate and biseriate, ellipsoid to cylindric, rounded at the ends, non-septate, occasionally 1-septate, (11.6)11.7-14.3(15.5) x (4.0)4.2-5.2(5.3) µm, K= 2.8. **Anamorph** unknown.



Ascospores of *H. lutescens*: 1 - 2. BRA, Moravia; 3 - 4. CUP 60688. x2000.

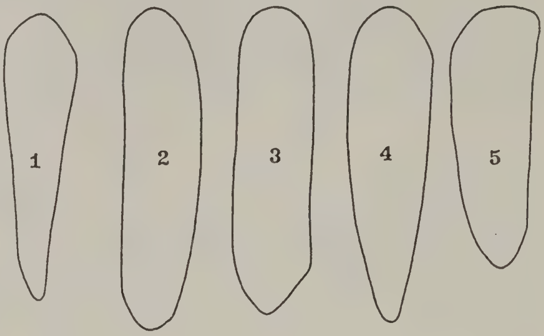
ILLUSTRATIONS: Hedwig (1789), Velenovský (1934, as *Helotium sazavae*), Dennis (1956); this paper.
HABITAT: On twigs (occasionally also on cones and needles) of conifers: *Abies alba*, *Picea abies*, *Pinus cembra*, *P. sylvestris*, *Pinus* sp. On twigs of broad-leaved trees: *Fagus sylvatica*, *Salix* sp.
DISTRIBUTION: ***Europe***: Czechoslovakia (Slovakia, Moravia), France, Germany, Great Britain, Hungary, Spain. ***North America***: U.S.A. **Slovakia**: Podunajská nížina Lowland: (7868) Posonium [Bratislava], *Salix* (Lumnitzer, 1791, as *Octospora lutescens* Hedw.); [? Hornádska kotlina Basin]: Igló [near Spišská Nová Ves] (Hazslinszky, 1886); [? Biele Karpaty Mts.]: Trencsén [near Trenčín] (Hazslinszky, l. c.).
SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Moravia**: Ždárské vrchy: ad lignum nud. in sphagneto Padrtiny prope pag. Račín distr. urb. Ždár n. S., 26.VIII.1971, P. Lizoň (BRA). **Spain**: On cones of *Pinus sylvestris*, Puerto de Canencia, Madrid, 8.XII.1983, R. Galán (CUP 60688).

There is no Slovak material preserved either at BP or at SLO and the above description is based on the material cited. I have not located the type material of *Octospora lutescens*. As briefly discussed by Svrček (1985), *O. lutescens* is probably a dubious name. He supposes *Hymenoscyphus sazavae* (Velen.) Svr. could be an acceptable name for this species.

The blue stain of ascus pore in Melzer's reagent is slight but clear in the Moravian collection. Dennis (1956) pointed out "the pore blue or not" and Baral (Baral & Krieglsteiner 1985) reported absence of this reaction. Dennis (l. c.) observed a wine-red stain of the excipulum in Melzer's reagent. The reddish-brown color of dry apothecia, as reported by Dennis (l. c.), is not present in Moravian and Spanish specimens (Galán, in litt., CUP). According to Baral (Baral & Krieglsteiner l. c.), fresh fruit-bodies are white. The species was described as having apothecia turning yellow "toto laeui lutescente" (Hedwig, 1789). The Spanish specimen (CUP) has spores 13.2-14.4 x 3.6-4.2 µm and a metachromatic reaction of the excipulum in Porrier's Blue, light blue stain of ectal excipulum and violet staining of the medullary excipulum (Korf, in litt., CUP).

Moser (1949) reported that *H. lutescens* has appeared one month after a fire but did not mention the actual substrate.

Hymenoscyphus ombrophilaeformis Svrček, Ces. Mykol. 31:11-13, 1977.



Ascospores of *H. ombrophilaeformis*: 1 - 3. BRA, *Acer*; 4 - 5. BRA, *Fagus*. x2000.

Apothecia dark violet when fresh, purplish-grey to purplish-brown when dry, 0.7 - 2.5 mm diam., short-stipitate, cupulate, scattered. Disc concave to plano-concave, occasionally convex at the centre, concolorous. Receptacle paler, reddish-purple, minutely downy. Stipe cylindric, the same color as the receptacle, downy, 1-2 x 0.4-0.6 mm; down composed of cells purplish-brown at the base and hyaline at the apex. Ectal **excipulum** well developed, 80 µm thick (at the margin 40 µm thick), of textura porrecta, composed of cylindric hyaline cells with thickened walls, 10-35 x 5-10 µm. Surface cells longer, 40-77 x 3.5-6.5 µm, terminal free cells 6.5-20 x 3-6.5 µm, containing deep violet-brown granular pigment. Medullary excipulum of textura porrecta, composed of hyaline hyphae 2.5 - 4 µm diam., irregularly septate (within 20 - 30 µm), curving to the subhymenium, of textura intricata, composed of thin-walled hyphae, 1 - 1.5 µm diam. Stipe tissue not differentiated into distinct layers, composed of cells 10-20 x 3-4 µm (textura porrecta). **Asci** cylindric-clavate, rounded at the apex, thin-walled, apex wall 2 - 3 µm thick, pore blue in Melzer's reagent, 120-140 x 8-9 µm. **Paraphyses** filiform, containing violet-brownish granular pigment, 2 - 3 µm diam. **Ascospores** irregularly fusoid, irregularly ellipsoid to cylindric-ellipsoid, rounded at the proximal end, tapered to the usually acute distal end, hyaline, non-septate, rarely 1-septate, (18.2)20.1-23.4(24.2) x (4.2)4.5-5.6(7.4) µm, K= 4.3. **Anamorph** unknown.

ILLUSTRATIONS: Svrček (1977); this paper.
HABITAT: On trunks and twigs of broad-leaved trees (lying in a stream): *Acer* sp., *Fagus sylvatica*.
DISTRIBUTION: ***Europe***: Czechoslovakia (Slovakia, Bohemia). **Slovakia**: Strážovské vrchy Mts. (7076).
SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Strážovské vrchy: (7076) Pružina, in valle rivuli Dobovsek ad pedem montis Strážov, ad truncum *Fagi* in aqua rivuli immersum, 22.IX.1075, M. Svrček [+ P. Lizoň & J. Kubička] (PRM 799372, holotype; Svrček, 1977); ibidem, ad lignum *Aceris* loco "Vodopád" dict. in clivo sept. mont. Strážov in valle rivi Dobovsek prope pag. Pružina - Predhorie, cca 800 m, 19.X.1982, P. Lizoň (BRA); ad lignum *Fagi sylv.* in rivulo in valle rivi Dobovsek ad pedem mont. Strážov prope pag. Pružina - Predhorie, cca 700 m, 18.IX.1982, P. Lizoň (BRA).

Hymenoscyphus ombrophilaeformis is a distinctive species in the genus *Hymenoscyphus* recognized by its violet fruit-bodies and lignicolous habit. Violet but paler apothecia are also seen in *Hymenoscyphus syringicolor* Svr. which is associated with leaves. The violet-brown pigment of *H. ombrophilaeformis* is concentrated particularly in the paraphyses and the disc is the deepest colored part of the fruit-body. Superficial cells of the excipulum contain less pigment. Long stipitate apothecia of similar color (dark violet when fresh) are reported in *Hymenoscyphus boraginensis* (Velen.) Svr., growing on *Myosotis palustris* (Svrček, 1985).

I have examined the holotype specimen, my collection from the same site, and a collection found about 2 km north of the holotype locality. All specimens studied agree in all characters. The holotype has spores (16.8)17.8-21.9(22.0) x (4.2)4.4-5.4(5.8) µm, K= 4.1, a narrower shape than given by Svrček (l. c., K= max. 3.7). His measurements of the spores (19-22 x 6-6.5 µm) are probably based on fewer spores.

The species is associated with (or it prefers), as do *H. imberbis* and *H. virgultorum*, wood lying in water. Svrček (in litt.) examined a collection from the Sumava Mts. in Velenovský's herbarium which is identical with this species.

Hymenoscyphus ombrophilaeformis is clearly congeneric with members of *Hymenoscyphus*. It shows some similarities to the group of *H. serotinus* but it has an isolated position within the genus.

Hymenoscyphus pallide-subolivaceus (Svrček) Lizoň, Mycotaxon 44:321, 1992.

≡ *Helotium pallide-subolivaceum* Svrček, Čes. Mykol. 12:228, 1958.

Apothecia yellow to greenish and 0.5 - 0.9 mm diam. when fresh, yellow to apricot-yellow and about 0.3 mm diam. when dry, short-stipitate, shallow cupulate, scattered. Disc concolorous, concave. Receptacle concolorous, naked. Stipe only 0.1 x 0.1 mm when dry. Ectal **excipulum** of textura porrecta, at the base of the receptacle composed of large cells about 15 x 5 µm, with slightly thickened walls, elongated towards the margin and forming a layer of narrow hyphae 2 - 4 µm diam. Medullary excipulum of textura intricata. **Asci** cylindric-clavate, conical at the apex, pore weakly but undoubtedly blue in Melzer's reagent, 60-65 x 6 µm. **Paraphyses** filiform, apex obtuse, about 3 µm diam. **Ascospores** irregularly biseriate, ellipsoid-clavate to fusoid-clavate, some of them irregular, rounded at the proximal end and sometimes with a short beak, tapered toward the distal end, non-septate, 10.2-12.5 x (1.8)2.5-3.0 µm, K= 4.4. **Anamorph** unknown.

ILLUSTRATIONS: Svrček (1958).
HABITAT: On needles of conifers: *Abies alba*, *Picea abies*. On leaves of

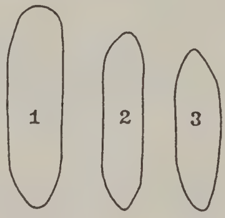
broad-leaved shrubs: *Vaccinium myrtillis*.
DISTRIBUTION: ***Europe***: Czechoslovakia (Slovakia) **Slovakia**: Belianske Tatry Mts. (6787).
SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Belianské Tatry: (6787) supra Tatranská Kotlina, Ad acus *Abietis albae*, *Piceae abietis*, folia *Vaccinii myrtilli* etc., 1000 m, 19.V.1958, J. Kubička & M. Svrček (PRM 586641, holotype; Svrček, 1958).

The above description is compiled from the holotype, the only known collection of this taxon. My observations agree in all respects with the original description by Svrček (l. c.).

The shape of spores resemble those of *Hymenoscyphus caudatus* and the species seems to be closely related to the group of *H. caudatus*.

Hymenoscyphus phyllogenon (Rehm) O. Kuntze, Rev. Gen. Pl. 3(2):486, 1898.
≡ *Helotium phyllogenon* Rehm, Hedwigia 24:14, 1885.
≡ *Phialea phyllogenon* (Rehm) Saccardo, Syll. Fung. 8:274, 1889.
= *Peziza epiphylla* var. *populina* Lasch in Rabenhorst, Flora 38:267, 1855.

Apothecia white, yellow to ochraceous when dry, 0.3 - 0.5 mm diam, short-stipitate, cupulate. Disc concave to plane at maturity, concolorous. Stipe, cylindric, naked, concolorous, 0.5 x 0.1-0.2 mm. Ectal **excipulum** of textura porrecta, a layer about 15 µm thick, deep blue in Cotton Blue, composed of cells 15-20 x 4-5 µm. Medullary excipulum of textura porrecta, composed of hyphae 2 - 3 µm diam., staining only slightly in Cotton Blue. **Asci** cylindric-clavate, pore blue in Melzer's reagent, 65-75 x 8-10 µm. **Paraphyses** filiform, slightly expanded upwards to about 3 µm diam. **Ascospores** uniseriate or irregularly biseriate, cylindric-ellipsoid, non-septate, 12-16 x 4-6 µm, K= 3.5. **Anamorph** unknown.



Ascospores of *H. phyllogenon*: 1 - 2. FH, Denmark; 3. FH, Ascomyceten no. 768, lectotype. x2000.

ILLUSTRATIONS: White (1943), Dennis (1956, 1960, 1968, 1978); this paper.
HABITAT: On fallen leaves of broad-leaved trees: *Populus nigra*, *Populus* sp., *Quercus* sp., *Salix atrocinerea*, *S. caprea*.
DISTRIBUTION: ***Europe***: Austria, Czechoslovakia (Slovakia), Denmark, Germany, Great Britain, Hungary, Spain. ***Africa***: Morocco. **Slovakia**: Nízke Tatry Mts.: (7083) *Salix caprea*, Srdiečko [at the foot of the hill Chopok] (Svrček, 1962); Podunajská nížina Lowland: (7868) Mühlau [Bratislava, the site of the present Press-Center] (Bäumler, 1897).
SPECIMENS EXAMINED: ***Europe***: **Hungary**: an faulenden Pappel-Blätter bei Ungarisch-Altenburg [Mosonymagyaróvár], X.1883, Linhart (FH, Rehm, Ascomyceten no. 768, 1884; type collection, lectotype; general collection, isotype; exsiccatae collection, isotype). **Denmark**: On *Quercus* leaves.

Bromme Plantage near Soro, 19.X.1978, D. H. Pfister (FH D-45).

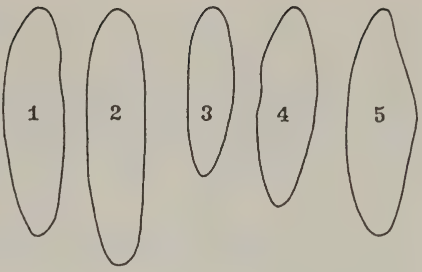
I have examined an isotype specimen (FH) which consists of a single ochraceous fruit-body, 0.5 mm diam. when dry. Asci are 70-76 x 5-6 µm, spores are ellipsoid, 9.9-10.8 x 2.2-2.7 µm. White (in litt., FH) reported spores 11.5-14 x 3.2-3.9 µm (type collection), 11.7-14.4 x 3.8-4.2 µm (general collection), 11.5-16.9 x 3.9-4.6 µm (exsiccatae collection). I designate the specimen in type collection at FH as lectotype of *Helotium phyllophilum*. The Denmark specimen has yellowish apothecia, asci 66-96 x 5-10 µm, cylindric-ellipsoid spores, 11.7-13.5 x 3.6-3.8 µm. I have not located Slovak collections either at PRM or at BP.

Hymenoscyphus phyllogenon is closely related to *H. phyllophilus* and this fact was accented by Rehm (1885a) in the original description: "Steht den Helotium phyllophilum ... nahe, unterscheidet sich aber durch viel viel grössere Perithecien [sic!] und verschieden geformte Sporen." Both species have been accepted by White (1943) and Dennis (1956). The species are macromorphologically nearly indistinguishable. *H. phyllogenon* has wider non-septate ascospores and is associated mainly with *Populus*. Spores of *H. phyllophilus* are narrower, fusoid, 1-septate and leaves of *Fagus sylvatica* are the typical substrate. *Hymenoscyphus caudatus*, a member of this group, has significantly larger clavate spores. A similar species with smaller spores (7-9.5 x 2-2.5 µm) also on poplar leaves is *Hymenoscyphua populneus* (Velen.) Svr. (Svrček, 1985).

Hymenoscyphus phyllophilus (Desmazières) O. Kuntze, Rev. Gen.. Pl. 3/2:485, 1898.

≡ *Peziza phyllophila* Desmazières, Ann. Sci. Nat., ser. 2, 17:98, 1842.
≡ *Helotium phyllophilum* (Desm.) Fries, Summa Veg. Scand., Sect. Post., p. 356, 1849.
≡ *Pezicula phyllophila* (Desm.) P. Karsten, Mycol. Fenn. 1:167, 1871.
≡ *Phialea phyllophila* (Desm.) Gillet, Champ. France Discom. p. 105, 1881.
≡ *Allophylaria phyllophila* (Desm.) P. Karsten, Acta Soc. Fauna Fl. Fenn. 3:131, 1885.
≡ *Calycina phyllophila* (Desm.) Baral in Baral & Krieglsteiner, Beih. Z. Mykol. 6:59, 1985.
= *Phialea phyllophila* var. *jaapii* Rehm in Jaap, Verh. Bot. Ver. Prov. Brandenburg 49:10, 1908.

Apothecia minute, white or whitish when fresh, light yellow when dry, (0.2)0.4 - 0.7 mm diam., short-stipitate, scattered. Disc concolorous. Receptacle toward the base minutely downy. Stipe whitish or translucent (also when dry), naked, 0.2 x 0.1 mm. Ectal **excipulum** of textura porrecta to textura angularis, composed of ± isodiametric cells, 4 - 5 µm diam. at the base of the receptacle, and cylindric cells 10-12 x 3 µm towards the margin. Medullary excipulum of textura intricata. **Asci** clavate, apex conical, pore blue in Melzer's reagent, 65-75(90) x (7)8-9 µm. **Paraphyses** filiform, non-septate, obtuse at the apex, 2 - 3 µm diam. **Ascospores** biseriate, cylindric-fusoid or inequilateraly ellipsoid, usually tapered on the ends, 1-septate, 12.0-15.0(16.5) x 3.0-4.0(4.5) µm, K= 3.8. **Anamorph** unknown.



Ascospores of *H. phyllophilus*: 1 - 2. BRA, Slovensky kras Mts.; 3 - 4. FH, Pl. Crypt. France no. 1159, lectotype; 5. FH, Fungi Sel. Exsic. no. 152, var. *jaapii*. x2000.

ILLUSTRATIONS: White (1943), Dennis (1956, 1960, 1968, 1978); this paper.
HABITAT: On fallen leaves of broad-leaved trees (on or near veins): *Acer platanoides*, *Acer* sp., *Aesculus hippocastaneus*, *Alnus* sp., *Castanea vesca*, *Fagus sylvatica*, *Populus canadensis*, *P. tremula*, *Populus* sp., *Quercus* sp.
DISTRIBUTION: ***Europe***: Austria, Czechoslovakia (Slovakia), France, Germany, Great Britain, Poland. **Slovakia**: Slovenský kras Mts. (7390); Nízke Tatry Mts.: (7083) *Fagus*, Srdiečko [at the foot of the hill Chopok], (Svrček, 1962).
SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Slovenský kras: (7390): ad folia *Fagi sylv.* in clivo mont. Krásna skala prope pag. Kováčová, 500 - 700 m, 9.X.1968, P. Lizoň (BRA). **Austria**: an faulenden Pappeln Erlen Bl., Prater [Wien], 1.XI.1902, F. von Höhnel (FH, herb. von Höhnel). **France**: in foliis semiputridis *Acerum* et *Fagorum* (FH, Desmazières, Pl. Crypt. France, ed. 1, no. 1159, 1842; lectotype). **Germany**: Auf den Nerven faulender Blätter von *Populus canadensis* Mickx. Prov. Brandenburg: Triglitz in der Prignitz, 10.X.1905, O. Jaap (FH, Jaap, Fungi Sel. Exsic. no. 152, 1906; isotype of *Phialea phyllophila* var. *jaapii*).

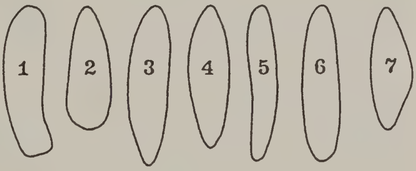
The Slovak specimen agrees in all aspects with the description by Dennis (1956) and the lectotype specimen at FH, as well. I observed smaller spores (9.9-10 x 1.3-1.8 µm) in the lectotype collection but White (in litt., FH) reported also spores 13.2 x 3.8 µm. A translucent to hyaline stipe was present also in the type material. The Austrian specimen, identified by Arendholz (in litt., FH) as *Hymenoscyphus caudatus* has relatively small spores, 10.8-12.6 x 2.7-3.1 µm. I have examined an isotype specimen of *Helotium phyllophilum* var. *jaapii* and I accept the conclusions by White (1943) and by Carpenter (1981) that it is synonymous. Arendholz (1979) referred this variety to synonymy with *H. caudatus*.

Desmazières (1842) originally described *H. phyllophilus* on leaves of *Acer* and *Fagus*. Carpenter (1981) was not able to identify the substrate of the lectotype specimen (FH, bound set of Desmazières's exsiccatae) designated by Dumont (1981). White (1943) found only leaves of *Fagus* (observed at FH also by me) in this collection. Specimens published in both Desmazières's exsiccatae editions have to be studied to determine if the collections on *Acer* and *Fagus* are conspecific.

Hymenoscyphus phyllophilus is closely related to *H. phyllogenon* and *H. caudatus*, and Dumont (1981) pointed out *H. phyllophilum* and *H. caudatus* may be conspecific. He reported that except for lack of the spore septum he did not find significant differences in the type material of these taxa. Collections of *H. caudatus* that I studied have larger fruit-bodies, long stipe (longer than the diameter of the receptacle), typically clavate and larger spores (18 - 25 µm long). According to these differences, both taxa are treated here as distinct species (in agreement with White, Dennis and Svrček).

Hymenoscyphus repandus (Phillips) Dennis, Persoonia 3:75, 1964.

≡ *Helotium repandum* Phillips, Brit. Discom. p.161, 1887.
≡ *Calycina repanda* (Phill.) O. Kuntze, Rev. Gen.. Pl. 3(2):449, 1898.
= *Helotium repandum* f. *citrinipes* Svrček, Čes. Mykol. 16:113, 1962.
= *Helotium vaginale* Velenovský, Monogr. Discom. Boh. 1:200, 1934.



Ascospores of *H. repandus*: 1 - 3. PRM, Nízke Tatry Mts.; 5 - 6. BRA, Veporské vrchy Mts.; 7. BRA, Biele Karpaty Mts. x2000.

Apothecia bright yellow to ochre-yellowish, 0.5 - 1 mm diam., long-stipitate, cupulate, scattered or gregarious. Disc plane, ochraceous-yellow. Receptacle concolorous, naked. Stipe conspicuously long, paler than receptacle, whitish or white, cylindric, expanded at the base, 0.6-2.0 x 0.1-0.4 mm. Ectal **excipulum** of textura porrecta, composed of rectangular cells, 10-14 x 6-9 µm, towards the margin the cells become narrower, forming hyphae 3 µm diam. Ectal layer of the stipe composed of cells 8.3-16.5(25) x 4-6.5 µm. Medullary excipulum of textura porrecta and becoming textura intricata in the subhymenial part of the receptacle, composed of hyphae 3 µm diam. **Asci** clavate, apex rounded, pore blue in Melzer's reagent, 50-66 x 3.5-6.5 µm. **Paraphyses** filiform, obtuse at the apex, about 2 µm diam. **Ascospores** irregularly biseriate or uniseriate, irregularly ellipsoid to fusoid, slightly curved, non-septate, occasionally 1-septate, (6.3)7.3-10.1(11.0) x (1.1)1.3-2.7(2.9) µm, K= 4.4. **Anamorph** unknown.

ILLUSTRATIONS: Velenovský (1934), Dennis (1956, 1968, 1978); this paper.
HABITAT: On herbaceous stems: *Cirsium* sp., *Filipendula ulmaria*, *Galeobdon luteum*, *Geranium* sp., *Halimone* sp., ? *Impatiens* sp., *Iris* sp., *Juncus* sp., *Lycopus europaeus*, *Mercurialis* sp., *Rubus idaeus*, *Rumex alpinus*, *R. obtusifolius*, *Sambucus ebulus*, *Ulex* sp. On twigs of broad-leaved trees: *Alnus* sp. On pericarps: *Aesculus* sp.

DISTRIBUTION: ***Europe***: Czechoslovakia (Slovakia, Moravia, Bohemia), Germany, Great Britain, Spain, Switzerland. **Slovakia**: Veporské vrchy Mts. (7284), Nízke Tatry Mts. (7183), Biele Karpaty Mts. (7073).
SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Veporské vrchy: (7284) in caulibus arrid. in jugo mont. Dlhý Grúň prope pag. Cierny Balog, 28.VII.1978, P. Lizoň (BRA); Nízke Tatry: (7183) in valle rivi Bystrý potok infra Srdiečko [at the foot of the hill Chopok], *Rumex alpinus*, 1150 m, 6.IX.1960, J. Kubička (PRM, Svrček, 1962); Biele Karpaty: (7073) in caulibus arrid. *Sambuci ebuli* in convalle prope pag. Drietoma, 21.VI.1981, P. Lizoň (BRA).

I have not examinated the holotype of *Helotium repandum* but I accept its placement in *Hymenoscyphus* close to *H. scutulus* by Dennis (1964). It is rather closely related to *Hymenoscyphus robustior* (P. Karst.) Dennis (Dennis, 1956), which has brownish apothecia when dry. *H. repandus* as illustrated by Breitenbach & Kränzlin (1981) is probably a distinct taxon (Baral & Krieglsteiner, 1985).

Svrček (1962) described a new variety, *Helotium repandum* var. *citrinipes* Svr., as having a yellow stipe. Such a color character is a very dubious basis for infraspecific distinctions because it depends on fruit-body conditions (moisture, age, etc.). Svrček (l. c.) himself pointed out, collecting both white and yellow fruit-bodies of *H. immutabilis*, that "This is an additional proof of the color changeability by helotioid species."

Velenovský (1934) described *Helotium repandum* var. *rumicis* Velen. as growing on the stem of *Rumex*. Svrček (1985) considers this taxon to be conspecific with *Hymenoscyphus vitellinus* (Rehm) O. Kuntze sensu Svrček, but not with *H. scutulus*, close to which *H. vitellinus* is placed, as a minute pale form, by Dennis (1956). According to original description (Velenovský l. c.) var. *rumicis* has spores 15 - 30 µm long (Svrček reported spores 14-21.5 x 3-4 µm), and they are larger than in *H. repandus*. *Hymenoscyphus symphoricarpi* Phill. on *Symphoricarpus racemosus* is probably also conspecific with *H. repandus* (Dennis, 1972).

The specimens studied agree with published data. Phillips (1887) reported spores 7-10 x 2 µm. Svrček (1962) described his var. *citrinipes* as having spores 9 - 12 µm long. I have examined the holotype of var. *citrinipes* and find the spores not exceeding 11 µm.

Philips (1887.) noted the "stem very short" and neither Massee (1895) nor Dennis (1956) saw the type specimen from Scotland. Dennis (l. c.) "accept[s] Crossland's interpretation as his material agrees with the diagnosis except for its longer stipe." The contemporary concept of the species, as presented also here, includes long stipitate apothecia (stipe as long as or longer than diameter of the receptacle).

Hymenoscyphus rokebyensis (Svrček) Matheis, Mitt. Thurgau. Naturf. Ges. 43:157, 1979.

≡ *Helotium rokebyense* Svrček, Čes. Mykol. 16:113, 1962.
≡ *Helotium fructigenum* (Bull. : Fr.) Fuck. forma sine nomine Dennis, Mycol. Pap. 62:80, fig. 72B, 1956.
= *Hymenoscyphus fructigenus* var. *coryli* (Feuill. in Roum.) Hengstmengel, Persoonia 12:489, 1985.
≡ *Helotium fructigenum* var. *coryli* Feuilleaubois in Roumeguère, Fungi Gall. Exs. no. 3727, 1886; Rev. Mycol. 8:149, 1886.

Misappl. *Ombrophila faginea* (Pers. : Fr.) Boudier, Hist. Class. Discom. Eur. p. 72, 1907.

Apothecia whitish, 1 - 1.5 mm diam. when fresh, deep yellow to yellow-brownish when dry, short-stipitate, cupulate, scattered. Disc concave, concolorous. Receptacle concolorous, naked. Stipe yellow, naked, shorter than half of the diameter of the receptacle, 0.3-0.4 x 0.2-0.3 µm. Ectal **excipulum** of textura porrecta, a layer 45 - 75 µm thick, composed of cells 10-24 x 1.5-3.2 µm, in straight rows or undulating at a very low angle to the surface. Medullary excipulum of textura porrecta, a layer 30 - 50 µm thick, composed of compressed hyphae 1.5 µm diam., staining very well in phloxine. Subhymenium of textura intricata, a layer 60 - 75 µm thick, composed of hyphae 1 - 1.5 µm diam. Ectal layer of stipe to 100 µm thick, composed of cells 6.5-10 x 2 µm, medullary part about 150 µm thick, composed of hyphae 1 µm diam. Towards the margin cells elongated, 26.5 x 1.5 µm. **Asci** cylindric-clavate, apex rounded with a wall to 2.5 µm thick, pore blue in Melzer's reagent, 90-100(110) x 7.5-10 µm. **Paraphyses** filiform, about 2 µm diam. **Ascospores** biseriate, irregularly ellipsoid to turbinate, rounded at the proximal end and tapered towards the distal end, non-septate, with granular contents, (11.6)12.5-13.9(14.7) x (3.0)3.3-3.9(4.2) µm, K=3.7. **Anamorph** unknown.

ILLUSTRATIONS: Boudier (1908, as *Ombrophila faginea*), Dennis (1956), Svrček (l. c.), Baral & Krieglsteiner (1985).
HABITAT: On fallen pericarps: [probably only] *Fagus sylvatica*.
DISTRIBUTION: ***Europe***: Czechoslovakia (Slovakia, Bohemia), France, Germany, Great Britain, Switzerland. **Slovakia**: Nízke Tatry Mts. (7183); Oravské Beskydy Mts.: (6482) *Fagus*, Mała Babia Góra [hill Babia hora] (Bujakiewicz, 1979).
SPECIMEN EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Nízke Tatry: (7183) Srdiečko [at the foot of the hill Chopok], in valle Bystrý potok, ad cupul. iac. *Fagi sylv.*, cca 1150 m, M. Svrček & M. Mates, 5.-6.IX.1960 (PRM 614225, holotype; Svrček, 1962).

The type specimen consists of several fruit-bodies arising from one whole and one fragment of a beech cupule. Apothecia are deep yellow when dry, and they become brownish after multiple rehydrations. The specimen agrees in all characters with the description of the British collection (Dennis, l. c.).

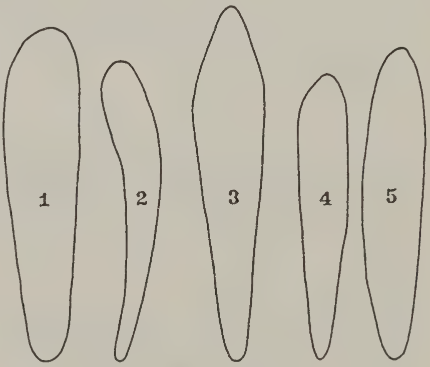
The structure of excipular tissues corresponds with the drawing of the British collection (Dennis, l. c.). Svrček (l. c.) describes the excipulum as forming two layers, and the inner layer to be composed of ellipsoid to globose cells, 10-20 x 7-14 µm. I have observed, in accordance with Dennis (l. c.), the medullary excipulum composed of parallel hyphae. Svrček (l. c.) and Matheis (1979) give the spore size range as 13-16 x 3.5-4 µm and 12-15.5 x 3.4-4.5 µm, respectively; my measurement are at the lower end of this range. Matheis (l. c.) noted that the spores are 1-septate at maturity, but I have not seen these.

I studied the description and illustration of *Ombrophila faginea* (Pers.) Boud. by Boudier (1908) and concur with Svrček (l. c.) and Korf (1988) that it is conspecific with the present species. The shape of the ascospores is similar and a convex disc is present only on old fruit-bodies. Boudier (1908) gives larger spores and asci but according to Brummelen (1969) Boudier's measurements were usually about 10 % too large.

The species is rare and Svrček (1985) discovered two additional collections by Velenovsky from Central Bohemia, originally identified as *Helotium fagineum* (Pers. : Fr.) Fr.

Hymenoscyphus salicellus (Fries) Dennis, Persoonia 3:73, 1964.

≡ *Peziza salicella* Fries, Syst. Mycol. 2:133, 1822; [non *Peziza salicella* Lasch in De Notaris, Comm. Soc. Crittog. Ital. 1(5):382, 1864].
≡ *Helotium salicellum* (Fr.) Fries, Summa Veg. Scand., Sect. Post., p. 356, 1849.
= *Helotium badium* Phillips, Brit. Discom. p. 167, 1887.



Ascospores of *H. salicellus*: 1. NY, Košická kotlina Bas.; 2. NY, Fungi Hung. Exsic. no. 479; 3. CUP, Fungi Sel. Exsic. no. 221; 4 - 5. NY, Ascomyceten no. 208. x2000.

Apothecia yellowish when fresh, reddish-brown to ochraceous when dry, 1 - 2 mm diam., short-stipitate, cupulate, gregarious. Disc plane at maturity, concolorous, paler and slightly undulate at the margin when dry. Receptacle flattened at maturity, naked. Stipe concolorous, 0.5-1.5 x 0.3 mm. Ectal **excipulum** of textura porrecta, composed of cells to 4 µm diam., lying parallel with the surface. Medullary excipulum of textura intricata, composed of compacted interwoven hyphae, 2 - 3 µm diam., with thickened walls, loosely interwoven in the subhymenium. **Asci** cylindric-clavate, conical at the apex, pore blue in Melzer's reagent, 120 x

11-15 µm. **Paraphyses** filiform, 2 µm diam. **Ascospores** irregularly biseriate, fusoid to ellipsoid-clavate, inequilateral, non-septate, (20.0)21.6-25.0(26.4) x (3.6)4.2-4.8(5.4) µm, K= 5.3. **Anamorph** unknown. Berthet (1964b) reported only a sterile mycelial culture.

ILLUSTRATIONS: Velenovský (1934), Dennis (1964); this paper.
HABITAT: On twigs of broad-leaved trees: *Salix alba, S. atrocinerea, S. fragilis, Salix* sp.
DISTRIBUTION: ***Europe***: Belgium, Czechoslovakia (Slovakia, Moravia, Bohemia), Estonia, Finland, France, Germany, Great Britain, Hungary, Italy, Romania, Sweden. ***North America***: U.S.A. **Slovakia**: Košická kotlina Basin (? 7093); Slovenský kras Mts.: (7488) *Salix*, Szalócz és Berzéte közöt [between Slavec and Brzotín] (Bánhegyi, 1942); Volovské vrchy Mts.: (7389) Rozsnyó, Rákoshegy [hill Rákoš near Rožňava] (Bánhegyi, l. c.); Východoslovenská rovina Lowland: Zemplén [Zemplín] (Hazslinszky, 1886).
SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Košická kotlina: (? 7093) Eperjes [Prešov], *Salix*, F. Hazslinszky (NY; Hazslinszky, l. c.). **Czechoslovakia, Bohemia** centr.: Praha 6 - Dolní Počernice, in silva madida, Ad ramos emortuos in aere prominentes *Salicis* sp., 21.VII.1979, M. Svrček (CUP, Svrček, Fungi Sel. Exsic. no. 22). **Hungary**: Auf Aesten von *Salix* sp., Bei Ung.-Altenburg [Mosonmagyaróvár], X.1885, Linhart (NY, Linhart, Fungi Hung. Exsic. no. 479, 1886). **Germany**: Halle a/S., auf der ... von faulenden ..., IX.1873, G.Winter (NY, Rehm, Ascomyceten no. 208, 1874).

At first, I could not confirm the identity of the published data on *Hymenoscyphus salicellus* from Slovakia since there were no available specimens at BP. Later, I have located a collection by Hazslinszky at NY and find that it agrees in all aspects with *H. salicellus* as presented here. I have not seen the collection of this species reported by Bolla (1858) from West Slovakia "auf faulenden Stengeln von *Solanum dulcamara* bei St. Georgen [Sväty Jur]", which probably represents, according to its herbaceous habit, a distinct taxon.

Hymenoscyphus salicellus seems to be rare and only few taxonomic data have been published. The concept of the species, as understood here, follows Dennis (1956), Phillips (1887) and Rehm (1893). It can be readily recognized by its large fusoid-clavate spores, rather thick-walled hyphae of the medullary excipulum, and its association with *Salix*. All these characters distinguish it from the closely related *H. serotinus* and *H. virgultorus*.

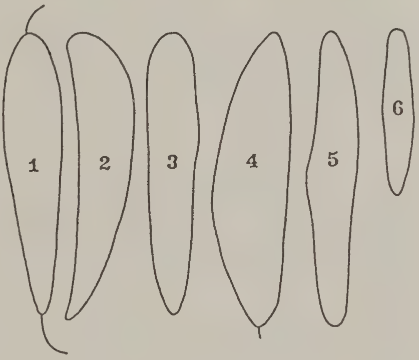
Hymenoscyphus scutulus (Persoon : Fries) Phillips, Brit. Discom. p. 137, 1887.

≡ *Peziza scutula* Persoon, Mycol. Europ. 1:284, 1822; Fries, Syst. Mycol. 2:123, 1822.
≡ *Helotium scutula* (Pers. : Fr.) P. Karsten, Not. Sällsk. Fauna Fl. Fenn. 11:233, 1870.
≡ *Phialea scutula* (Pers. : Fr.) Gillet, Champ. France Discom. p. 108, 1881.

≡ *Helotium virgultorum* (Wigg.) Fr. var. *scutula* (Pers. : Fr.) Rehm, Ascom. Lojkani p. 7, 1883.
≡ *Calycella scutula* (Pers. : Fr.) Quélet, Enchir. Fung. p. 305, 1885.
= *Helotium acutisporum* Velenovský, Monogr. Discom. Boh. 1:198, 1934.
= *Phialea appendiculata* Oudemans, Versl. Meded. Afd. Natuurk. Kon. Akad. Wetensch., ser. 3, 7:313, 1890.
≡ *Helotium appendiculatum* (Oudem.) Boudier, Hist. Class. Discom. Eur. p. 114, 1907.
= *Helotium aviculare* Velenovský, Novit. Mycol. Novis. p. 122, 1947.
= *Helotium cejpi* Velenovský, Monogr. Discom. Boh. 1:207, 1934.
= *Ciboria ciliatospora* Fuckel, Jahrb. Nass. Ver. Naturk. 23-24:311, 1870.
≡ *Belonioscypha ciliatospora* (Fuck.) Rehm, Rabenhorst's Krypt.-Fl. 1(3):744, 1893.
≡ *Helotium ciliatosporum* (Fuck.) Boudier, Hist. Class. Discom. Eur. p. 114, 1907.
≡ *Belospora ciliatospora* (Fuck.) Clements, Gen. Fung. p. 175, 1909.
= *Helotium scutula* (Pers. : Fr.) P. Karst. var. *cirsii* Velenovsky, Novit. Mycol. Novis. p. 121, 1947.
= *Helotium cyparissias* Velenovský, Monogr. Discom. Boh. 1:194, 1934.
= *Belonioscypha dulcamarae* Feltgen, Rec. Mém. Trav. Soc. Bot. Luxemb. 15:56, 1901.
≡ *Podobelonium dulcamarae* (Feltg.) P. A. & D. Saccardo, Syll. Fung. 18:106, 1906.
≡ *Belonidium dulcamarae* (Feltg.) Boudier, Hist. Class. Discom. Eur. p. 117, 1907.
= *Helotium epilobii* Velenovský, Monogr. Discom. Boh. 1:194, 1934.
= *Helotium scutula* (Pers. : Fr.) P. Karst. var. *genistae* Velenovsky, Novit. Mycol. Novis. p. 121, 1947.
= *Helotium geranii* Velenovský, Novit. Mycol. Novis. p. 122, 1947.
= *Helotium gracile* Cooke & Peck in Peck, Ann. Rep. N. Y. State Mus.26:83, 1874.
≡ *Hymenoscyphus gracilis* (Cooke & Peck in Peck) O. Kuntze, Rev. Gen. Pl.(3)/2:485, 1898.
≡ *Phialea gracilis* (Cooke & Peck in Peck) Saccardo, Syll. Fung. 8:265, 1889; [non *Phialea gracilis* (Quél.) Gillet, Champ. France Discom p. 99, 1881].
= *Helotium granulosum* Velenovský, Monogr. Discom. Boh. 1:193, 1934.
= *Helotium scutula* (Pers. : Fr.) P. Karst. var. *lysimachiae* Velenovsky, Novit. Mycol. p. 184, 1940.
= *Helotium nardi* Velenovský, Monogr. Discom. Boh. 1:199, 1934.
= *Helotium constantinii* Boud. var. *ochraceum* Velenovský, Monogr. Discom. Boh. 1:202, 1934.
= *Helotium scutula* (Pers. : Fr.) P. Karst. f. *rubi* Rehm, Hedwigia 24:229, 1885.
= *Hymenoscyphus scutulus* (Pers. : Fr.) Phill var. *rudbeckiae* Phillips, Brit. Discom. p.138, 1887.
≡ *Phialea scutula* (Pers. : Fr.) Gill. var. *rudbeckiae* (Phill.) Saccardo, Syll. Fung. 8:266, 1889.
≡ *Helotium scutula* (Pers. : Fr.) P. Karst. var. *rudbeckiae* (Phill.) Boudier,

Hist. Class. Discom. p. 114, 1907.
= *Helotium cejpi* Velen. var. *struthiopteridis* Velenovský, Monogr. Discom. Boh. 1:207, 1934.
= *Helotium variabile* Velenovský, Monogr. Discom. Boh. 1:199, 1934.
= *Helotium veledae* Velenovský, Novit. Mycol. Novis. p. 124, 1947.
= *Belonioscypha vexata* De Not. var. *typhina* Velenovský, Monogr. Discom. Boh. 1:213, 1934.
= *Helotium vitellinum* Rehm, Ber. Naturhist. Ver. Augsburg 26:124, 1881.
≡ *Phialea vitellina* (Rehm) Saccardo, Syll. Fung. 8:262, 1889.
≡ *Helotium scutula* (Pers. : Fr.) P. Karst. f. *vitellinum* (Rehm) Rehm, Rabenhorst's Krypt.-Fl. 1(3):794, 1893.
≡ *Hymenoscyphus vitellinus* (Rehm) O. Kuntze, Rev. Gen. Pl. 3(2):486, 1898.

Misappl.: *Helotium nubilipes* Boud. sensu Velenovský, Monogr. Discom. Boh. 1:194, 1934.
Helotium rubicola (Fr.) Fuck. sensu Velenovský, Monogr. Discom. Boh. 1:194, 1934.



H. scutulus: 1. BRA, Biele Karpaty Mts.; 2. BRA, Záhorská nížina Lowl..; 3. PRM 614227; 4. CUP 25494; 5. CUP-JA 253; 6. CUP, Mycoth. Germ. no. 397, f. *vitellina*. x2000.

Apothecia deep yellow to ochraceous-yellow when fresh, slightly darker when dry, 0.5 - 3(5) mm diam., long-stipitate, cupulate. Disc concave to plane at maturity, deep yellow. Receptacle yellow to ochraceous when dry, pale to lemon yellow in some fruit-bodies when fresh, naked. Stipe yellow to ochre, whitish downy, rather brownish when dry, always longer than the diameter of the receptacle, 1.5-3(5) x 0.1-0.3 mm. Ectal **excipulum** of textura porrecta, composed of angular cells, 10-25 x 5-10 µm. Medullary excipulum of textura porrecta, towards the subhymenium of textura intricata, composed of hyphae 3 - 5 µm diam. **Asci** clavate, conical at the apex, pore blue in Melzer's reagent, (85)100-120 x (6.5)7.5-8.5 µm. **Paraphyses** filiform, sometimes with granular deposit, apex obtuse, to 3 µm diam. **Ascospores** biseriate, irregularly ellipsoid or mostly clavate, rounded at the proximal end, with a blunt beak, tapered towards the distal end, often curved, with cilia on one or both ends or lacking cilia, containing 1 - 2 guttules when fresh, rarely with more guttules or lacking guttules, non-septate or some becoming 1- or rarely 2-septate, (16.8)18.6-24.0(28.4) x 3.0-4.1(4.5) µm, K= 5.8. Cilia curved, 2 - 3.5 µm long; if present on both spore ends, then both ends are pointed, but in several specimens lacking at both ends. **Anamorph** unknown. A mycelial culture produced an orange pigment (Berthet 1964b).

ILLUSTRATIONS: Rehm (1893), Velenovský (1934), White (1942a), Le Gal (1953), Dennis (1956, 1960, 1968, 1978), Thind & Singh (1961), Bøhler (1974), Breitenbach & Kränzlin (1981), Svrček (1985); this paper.

HABITAT: On herbaceous stems (particularly Asteraceae): *Artemisia campestris, A. vulgaris, Artemisia* sp., *Aster amellus, A. salicifolius, Aster* sp., *Ballota nigra, Chaerophyllum* sp., *Chamerion angustifolium, Centaurea jacea, Cirsium arvense, C. vulgare, Deschampsia caespitosa, Eupatorium* sp., *Filipendula ulmaria, Geum* sp., *Helianthus annuus, H. tuberosus, Hypericum perforatum, Leonurus marrubiastrum, Lycopus europaeus, Lysimachia vulgaris, Mentha longifolia, Mentha* sp., *Mulgedium* sp., *Oenothera biennis, Polygonum robustus, Polygonum* sp., *Potentilla norvegica, Reynoutria japonica, Rubus caesius, R. idaeus, Rudbeckia laciniata, Rumex hydrolapathum, Rumex* sp., *Sambucus ebulus, Scirpus holoschoenus, Senecio fuchsii, Solanum tuberosum, Solidago canadensis, Spiraea* sp., *Stenactis annuus, Tanacetum* sp., *Urtica dioica*. On sprouts (? not woody) of broad-leaved shrubs: *Rosa pimpi-nellifolia, Rubus fruticosus, R. idaeus, Teucrium* sp., *Vaccinium vitis-idaea*. On leaves and petioles of broad-leaved trees: *Populus* sp., *Salix* sp.

DISTRIBUTION: ***Europe***: Bulgaria, Czechoslovakia (Slovakia, Moravia, Bohemia), Estonia, France, Germany, Great Britain, Hungary, Poland, Romania, Russia, Slovenia, Spain, Switzerland. ***Macaronesia***: Madeira. ***Asia***: China, Japan, Pakistan. ***North America***: U.S.A. White (1942a) considers *H. scutulus* to be the most widespread species of the former genus *Helotium*. **Slovakia**: Malé Karpaty Mts. (7570), Strážovské vrchy Mts. (7076), Nízke Tatry Mts. (7183), Košická kotlina Basin (6993), Biele Karpaty Mts. (7172, 7173), Záhorská nížina Lowland (7668); Rožňavská kotlina Basin: (7389) *Artemisia vulgaris*, Rozsnyó [Rožňava] (Bánhegyi, 1942); Malé Karpaty Mts.: (7868) *Artemisia*, Hammerschmiede [Bratislava, on the foot of the hill Kramáre] (Bäumler, 1897); Im Gebirge [Bratislava, in the mountains] (Bäumler, 1927).

SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Malé Karpaty: (7570) in caulibus arrid. *Lycopus europ*. in clivo mont. Jelenec prope pag. Doľany, cca 500 m, 17.X.1972, P. Lizoň (BRA); Strážovské vrchy: (7066) in caulibus arrid. *Mentae ? longifol*. in valle rivi Dobovsek ad pedem mont. Sokolie prope pag. Pružina - Predhorie, 20.X.1982, P. Lizoň (BRA); Nízke Tatry: (7183) Srdiečko [on the foot of the hill Chopok], Fageto-Abietum, *Chamaenerium angustifol*., 1250 m, 5.IX.1960, Z. Moravec (PRM; Svrček, 1962); in valle Trangoška [on the foot of the hill Chopok], *Rubus idaeus*, 1200 - 1500 m, 8.IX.1960, M. Svrček (PRM; Svrček, l. c.); Košická kotlina: (6993) Eperjes [Prešov], *Rubus idaeus*, VIII. F. Hazslinszky (BP 58558, as *Helotium virgultorum*); ibidem, *Rubus idaeus*, F. Hazslinszky (BP 68553, as *Helotium virgultorum* b. *rubicolum*); Slanské vrchy: (6993) In ramulis [*Rubi*] locis udi, In valle Sebesiensi [in the valley of the creek Šebastovka near Vyšná Šebastová], IX., F. Hazslinszky (BP 68574, as *Helotium pallescens* b. *virgultorum*); Biele Karpaty: (7173) N. Podhragy [Zemianske Podhradie], in *Rubo caesio*, J. Ľ. Holuby (BP 68569, as *Helotium virgultorum*); (7172) in caulibus arrid. in prato uligin. in clivo collis Nová hora prope pag. Moravské Lieskové - Šance, cca 450 m, 16.IX.1979, P. Lizoň (BRA); (7173) in caulibus arrid. *Leonuri* *marrubiast.* in humentia in clivo austr. collis Nová hora prope pag. Moravské Lieskové-Šance, 17.X.1982, P. Lizoň (BRA); Záhorská nížina: (7668) in caulo arrid. in silva mixta (*Populus, Robinia, Pinus*) inter opp. Stupava et Lozorno, 16.X.1980, P. Lizoň (BRA). **Germany**: Mühlhausen (Elsass), in caulibus siccis *Asteris amelii*, Brenner (CUP, Rabenhorst, Fungi Europ. Exsic. no. 2105, 1876, as *Helotium scutula* var. *amenti*) **Hungary**: An faulenden *Rubus*-Zweigen bei Ungarisch-Altenburg [Mosonmagyaróvár], X.1884, Linhart (H, Rehm, Ascomyceten no. 808, 1885, isotype of *Helotium scutula* f. *rubi*).. [? **The Netherlands**]:...[on *Rubus*], 19.X.1950, R. A. Maas Geesteranus (CUP-G 1109, as *Helotium scutula* f. *rubi*). **Asia**: **China**: On stems of *Polygonum cuspidatum*, wood above Jianfugong, Qingchengsham, Guan Xian, Sichuan, 19.X.1981, R.-y. Zheng & R. P. Korf (CUP-CH 2413). **Japan**: on herbaceous stems, Homan Mt., near Fukuoka, Fukuoka Pref., Kyushu, 27.X.1957, S. Imai & al. (CUP-JA 253); on stem, along north shores of Lake Marunuma, Gumma Pref., Honshu, 7.X.1957, R. P. Korf (CUP-JA 118). ***North America***: **U.S.A.**: On old stems of *Polygonum*, New York City, N. Y., X.1906, F.J.Seaver (CUP, Bartolomew, Fungi Columb. no. 2339, 1907); On decaying stems *Polygonum robustus*, Cayuga Lake, N. Y., 1.IX.1936, H. H. Whetzel & W. L. White (CUP 25494); On herbaceous dry stems, Fall Creek, Varna, N. Y., 17.VI.1982, A. Bujakiewicz (CUP 59867); Dead stems of *Eupatorium*, Blue Ridge Mountains, Blowing Rock, Watanga and Caldwel Co., N. C., 3500 - 5000 ft., 20.VI.-14.IX.1901, E. J. Durand (CUP-D 12185); Blowing Rock, Watanga Co., N. C., VIII.1889, G. F. Atkinson (CUP-A 910).

The species *Hymenoscyphus scutulus* includes, without doubt, a whole range of forms but it does not seen possible to clearly define their limits. Probably the only distinct variety is var. *fucatus* Phill., which has large spores, 24-34 x 5-7 µm and is associated with *Polygonum*, and var. *solani* (P. Karst.) S. Ahmad (1978) [combination by Korf & Zhuang (1985a) superfluous], which has small spores, 14-19 x 3-4 µm. Probably the Slovak collections from Nízke Tatry Mts. represent the last variety. The synonymy, as presented here, follows investigations of type material by White (1942a), Carpenter (1981), and Svrček (1985). I have examined the isotype of *Helotium scutula* f. *rubi* Rehm at H and I conclude that this taxon is a synonym of *Hymenoscyphus scutulus*. Smaller and paler apothecia, as described by Rehm (1885b), are of little value for its distinction.

The concept of this species by Dennis (1956) follows investigations of the lectotype, which he designated, and descriptions by Fuckel, Karsten and Phillips, and is accepted also here. According to Dennis (l. c.), the lectotype has clavate spores, rounded at the proximal end and tapered towards the distal end, 20-22 x 4 µm, cilia to 5 µm long and asci 120 x 10 µm. I have not seen cilia longer than 3.5 µm in the collections I have examined. The lectotype was studied also by Carpenter (1981) who agrees with its placement to *Hymenoscyphus*.

The specimens studied agree in all aspects with Dennis's concept. Fruitbodies of *H.scutulus* resemble those of herbicolous species of *Hymenoscyphus* but such large, conspicuously long-stipitate apothecia are exceptional in this genus. The species is readily recognized by the shape and the size of spores. The presence of cilia alone may be a dubious basis for specific distinction since they are lacking in several collections. *Hymenoscyphus duriusculus* (Velen.) Svr. on oak twigs and *H. obtusus* (Velen.) Svr. on herbaceous stems seems to have some relationships to this species (Svrček, 1985).

Spore length ranges from 16.5 µm to 24 µm, and spores are reported to 35 µm (Dennis l. c., var. *fucatus*). I examined Slovak collections and find some differences in the size of spores and the presence of cilia. Collections from the Nízke Tatry Mts. have spores (16.8)17.3-21.2(22.7) x 3.1-3.7(4.0) µm and no cilia were observed. The other collections studied gave higher measurements, as (16.8)20.1-25.0(28.4) x (3.2)3.4-4.2(4.5) µm. Spore septation may be of little value as a character in this species. One or rarely 2 septa may develop in mature spores, usually close to germination (they germinate sometimes even in the ascus).

According to the illustration by Fuckel (1870), I agree with White (l. c.) and Carpenter (l. c.), who considered *Ciboria ciliatospora* to be synonymous with this species. Gremmen (1950) treated it as distinct taxon having wider spores. Svrček (1985) treated *Hymenoscyphus vitellinus* as a distinct species. I have not examined the holotype of *Helotium vitellinum* Rehm but I accept its placement in the synonymy of the present species by White (l. c.), Dennis (l. c.), and Carpenter (l. c.) (who has studied the holotype).

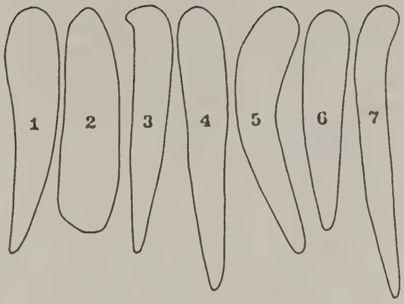
Hymenoscyphus serotinus (Persoon : Fries) Phillips, Brit. Discom. p. 125, 1887.

≡ *Peziza serotina* Persoon, Syn. Meth. Fung. p. 661, 1801; Fries, Syst. Mycol. 2:119, 1822.
≡ *Helotium serotinum* (Pers .: Fr.) Fries, Summa Veg. Scand., Sect. Post. p. 355, 1849.
= *Helvella aurea* Bolton, Hist. Fung. tab. 98, 1790.
≡ *Calycina aurea* (Bolt.) O. Kuntze, Rev. Gen.. Pl. 3(2):448, 1898.

Misappl.: *Hymenoscyphus calyculus*(Sow. : Fr.) Phill. sensu Breitenbach & Kränzlin, Pilze Schweiz 1:164, 1981.

Apothecia deep yellow when fresh, brownish when dry, (0.5)1 - 5 mm diam., early long-stipitate, cupulate, gregarious. Disc concave, becoming plane to slightly convex, yellow, towards the margin paler. Receptacle deep yellow, minutely downy. Stipe very long, downy, 0.5-4 x 0.5 mm. Ectal **excipulum** of textura porrecta, composed of rather thick-walled cells, 7-26 x 4-5 µm. Medullary excipulum of textura porrecta, not clearly delimited from the ectal excipulum, composed of cells about 3 µm diam. **Asci** clavate, conical at the apex, pore blue in Melzer's reagent, 110-140 x 8.5-11 µm. **Paraphyses** filiform, 2 - 3 µm diam. **Ascospores** biseriate, clavate, rounded at the proximal end and pointed at the distal end, straight or curved, non-septate, (11.0)19.0-24.7

(30.5) x (2.4)2.7-3.3(3.5) µm, K=7.6. **Anamorph** unknown.



Ascospores of *H. serotinus*: 1. CUP, Fungi Sax, Exsic. no. 2025; 2. CUP 50869; 3 - 4. BRA, Mal´Karpaty Mts., Pišút Opold; 5 - 6. BRA, Malé Karpaty Mts., Mäumler; 7. BRA, Poľana Mts. x2000.

ILLUSTRATIONS: Lagarde (1906), Velenovský (1934), Dennis (1956), Matheis (1985); this paper.
HABITAT: On twigs of broad-leaved trees: *Carpinus betulus*, *Fagus sylvatica*. On petioles of the leaves of broad-leaved trees: *Acer* sp.
DISTRIBUTION: ***Europe***: Belgium, Czechoslovakia (Slovakia, Moravia, Bohemia), Estonia, Germany, Hungary, Italy, Poland, Russia, Switzerland. ***Asia***: China. ***North America***: U.S.A. ***South America***: Colombia, Ecuador, Panama, Venezuela. **Slovakia**: Biele Karpaty Mts. (7173), Sarišská vrchovina Mts. (7093), Malé Karpaty Mts. (7669, 7768, 7868), Strážovské vrchy Mts. (7077), Slovensky kras Mts. (7390), Košická kotlina Basin (7093), Poľana Mts. (7382), Vihorlat Mts. (7098, 7799).
SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Biele Karpaty: (7173) Nemes Podhragy [Zemianske Podhradie], J. L. Holuby (BP 38569, as *Helotium virgultorum*); ibidem, in ramo *Fagi*, XI., J. L. Holuby (BP 68586); Sarišská vrchovina: (7093) levelek alatt fekvö ágakon, Czeméte, Eperjes [Cemjata near Prešov], XI., F. Hazslinszky (BP 68583; Hazslinszky, 1886); Malé Karpaty: (7868) ad ramos putridos *Fagi sylvatici* prope Pozsony [Bratislava], autumno, J. A. Bäumler (BRA, Krypt. Exsic. Mus. Palat. Vindob. no. 1927, 1912; Bäumler, 1897); (7669) sehr reichlich im Modereinerwald [Modra], 1.X.1912, J. A. Bäumler (BRA); (7669) ad ramum *Fagi sylv.* in clivo mont. Jelenec prope pag. Doľany, cca 500 m, 17.X.1972, P. Lizoň (BRA); (7768) ad ramulos. arb. frond. prope urbem Bratislava - Rača, 6.XI.1973, I. Pišút & L. Opold (BRA); Strážovské vrchy: (7077) ad truncum putr. *Fagi sylv.* in clivo sept.-orient. mont. Cierna hora prope pag. Pružina - Predhorie, 750 m, 19.VII.1966, P. Lizoň (BRA); (7077) ad ramum *Fagi sylv.* loco Krahulec prope mont. Strážov, 600 m, 28.X.1969, P. Lizoň (BRA); Malá Fatra: (6879) ad truncum putr. *Fagi sylv.* in clivo austro-occid. mont. Veľká Kráľová prope pag. Sučany, 500 - 1000 m, 12.VIII.1966, P. Lizoň (BRA; Lizoň, 1972); ibidem, ad ramulum putr. *Fagi sylv*. 900 - 1100 m, P. Lizoň (BRA); Slovensky kras: (7390) ad ramum *Fagi sylv.* in covalle Zádielská dolina, 350 - 700 m, 7.X.1968, P. Lizoň (BRA); ibidem, 8.-14.X.1934, A. Pilát (PRM 683904); (7390) ad ramum *Fagi sylv.* in clivo mont. Tegar prope pag. Kováčová, 750 m, 9.X.1968, P. Lizoň (BRA); Košická kotlina: (7093) Salgó felett [Salgovík], X., F. Hazslinszky (BP 68582); Poľana: (7382) ad ramulum *Fagi sylv.* in monte Predná Poľana prope casam ZTS haud procum a pago Hriňová, cca 1200 m, 19.IX.1979, J. Roth (BRA); Vihorlat: (7799) ad ramum *Fagi sylv.* ad ripam lacus Morské oko, 605 m, 31.X.1968, P. Lizoň (BRA); (7799) ad ramum *Fagi sylv.* in summo

mont. Sninský kameň, 995 m, 1.XI.1968, P. Lizoň (BRA); (7098) ad ramum *Fagi sylv.* in valle rivi Čeremošnia, 600 m, 5.XI.1968, P. Lizoň (BRA). **Germany**: Auf faulenden *Fagus*-Aesten auf dem Grossen Winterberge, selten, X.1892 u. 1898, Wagner & K. W. Krieger (CUP, Krieger, Fungi Sax. Exsic. no. 2025, 1907). ***North America***: **U.S.A.**: In petioles of *Acer* sp., Green Bluffs, near Spencer, Owen County, Indiana, 22.VIII.1970, R. P. Korf (CUP 50869).

In the group of lignicolous species of *Hymenoscyphus*, *H. serotinus* may be recognized by yellow long-stipitate apothecia, turning to reddish-brown when dry, and by large, non-septate, clavate spores. It should be noted that it is closely allied to *H. virgultorum*, but it is to be distinguished by clavate spores (*H. virgultorum* has fusoid spores). This is why I do not agree with a note by Dennis (l. c.) "is no more than a form of *H. calyculus* [*H. virgultorum*] with longer, more tapering spores."

In Europe, *H. serotinus* is associated exclusively with woody substrates, mainly with *Fagus sylvatica*. Dumont & Carpenter (1982) reported collections from South America on herbaceous stems and leaves. They briefly discuss the wide variability in macromorphological characters and conclude that American specimens are conspecific with the European fungus. I examined an Indiana collection on *Acer* referred by Korf (CUP) to this species. It agrees in most aspects with the concept, as presented here, but the spores are cylindric-ellipsoid and they are too thick (K= 4.9). A more detailed study of several specimens must be undertaken to determine whether the European collection on twigs are the same as those American on herbaceous stems and leaves.

The spore size of the Slovak collections corresponds with published data. Rehm (1893) reported spores 30 - 36 µm long and, according to Dennis (l. c.), this material appears to be closely related to *H. caudatus*. Such a forms, having spores 32-38 x 5-6 µm and 35-43 x 5- 8 µm, were observed and referred to *H. serotinus* by Dumont & Carpenter (l. c.). These are outside my concept of the species.

Type material of *Peziza serotina* has not been located in the Persoon's collection at L (Dennis, l. c.) and is unlikely to have survived. Fries (1822) did not know the species from his own experience ("v. ic.") and he probably accepted the description by Albertini & Schweinitz (1805) reporting leaves also as a substrate ("ad folia ramulosque putridos").

Hymenoscyphus subcarneus (Saccardo) O. Kuntze, Rev. Gen.. Pl. 3(2):486, 1898.

> ≡ [*Peziza subcarnea* Cooke & Peck in Cooke, Bull. Buffalo Soc. Nat. Sci. 2:295, March 1875, nom. illegit.; (non *Peziza subcarnea* Schum. = *Helotium subcarneum* (Schum.) Saccardo, Michelia 2:260, 1881)].

≡ *Phialea subcarnea* Saccardo, Syll. Fung. 8:265, 1889; [a new name, cfr. ICBN Art. 72, Note 1].
= *Helotium destructor* Peck in White, Mycologia 34:163-164, 1942a.

Apothecia pinkish when fresh, yellowish-hyaline and traslucent when dry, pink- brownish when rehydrated, about 0.5 mm (or less) diam., long- stipitate, cupulate, scattered. Disc concave, concolorous. Receptacle subglobose when young, later deep cupulate, naked, concolorous. Stipe concolorous, longer than diameter of the receptacle, not exceeding, 0.1 - 0.2 mm diam. Ectal **excipulum** of textura porrecta, composed of cylindric cells, up to 18.5 x 3.5 µm, clavate at the margin, lying in rows parallel to the surface. Medullary excipulum of textura porrecta, composed of narrow long-celled hyphae about 1.5 µm diam. **Asci** clavate, conical at the apex, pore weakly blue in Melzer's reagent, 40.5-60 x 5-6 µm. **Paraphyses** filiform, about 3 µm diam. **Ascospores** biseriate, clavate to pyriform, non-septate, 4.5-6.0 x 2.0-2.5 µm, K= 2.3. **Anamorph** unknown.

ILLUSTRATIONS: White (1942a).
HABITAT: On bryophytes: *Dicranum flagellare, Jungermania* sp., unidentified liverwort.
DISTRIBUTION: ***Europe***: Czechoslovakia (Slovakia). ***North America***: Canada, U.S.A. **Slovakia**: Belianske Tatry Mts. (6787).
SPECIMEN EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Belianske Tatry: (6787) in valle Holubyho dolina pr. Tatranská Kotlina, Ad hepaticam foliosam parasitica (ad truncum iac. Piceae abietis), VIII.1956, M. Svrček (PRM 817510; Svrček, 1959).

I examined the Slovak specimen (PRM) and find only young, not fully mature fruit-bodies. The above description is based on this specimen.

White (1942a) studied several specimens from the U.S.A. and proposed a new name, *Helotium destructor*. His proposal was necessary for treating this species in the genus *Helotium*, since there is already a lignicolous species, *Helotium subcarneum* (Schum.) Sacc. (Saccardo, 1881).

The parasitic habit of *Hymenoscyphus subcarneus*, as reported by White (l. c.) and Svrček (l. c.), is unusual in this group of fungi.

Peck (1875) pointed out that *Peziza subcarnea* is closely allied to *P. pyriformis* (Hedw. : Fr.) Fr. The last species was originally described as *Octospora pyriformis* by Hedwig (1789) on *Mnium*. Carpenter (1981) was not able to locate the type material but he admitted that the species could be a bryophilous member of *Hymenoscyphus*.

Hymenoscyphus tatrae (Svrček) Lizoň, Mycotaxon 44:322, 1992.

≡*Helotium tatrae* Svrček, Čes. Mykol. 12:228, 1958.

Apothecia bright lemon-yellow when fresh, yellowish when dry, 0.3 - 0.5 mm diam., long-stipitate, cupulate, scattered. Disc plane to slightly convex, concolorous. Receptacle concolorous, naked. Stipe cylindric, yellowish, towards the base brownish when dry, naked, at least 1.5x longer as the diameter of the receptacle, 0.5 x 0.1 mm. Ectal **excipulum** of textura globulosa at the base of the receptacle, composed of globose cells, 4.5 - 9(14.5) µm diam., and textura porrecta towards the margin, composed of cylindric cells, up to 22 x 6.5 µm. Medullary excipulum of textura intricata. **Asci** cylindric-fusoid, apex conical, pore weakly but undoubtedly blue in Melzer's reagent, 69-84(85) x 5-6.5(9) µm. **Paraphyses** filiform, obtuse at the apex, 2-2.5(5.5) µm diam. **Ascospores** irregularly biseriate, cylindric-ellipsoid to oval, rounded at the ends, non-septate, (8.0)8.5-11.0(11.5) x 1.5-2.5(4.0) µm, K= 4.5. **Anamorph** unknown.

ILLUSTRATIONS: Svrček (1958).
HABITAT: On needles of coniferous trees: *Larix decidua* subsp. *polonica*. On leaves of Cyperaceae: *Carex flacca* subsp. *claviformis*.
DISTRIBUTION: ***Europe:*** Czechoslovakia (Slovakia). **Slovakia**: Belianske Tatry Mts. (6787).
SPECIMEN EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Belianské Tatry: (6787) supra Tatranská Kotlina, 1250 m s.m., Ad acus *Laricis deciduae* subsp. *polonicae*, 19.V.1958, J. Kubička & M. Svrček (PRM 856642, holotype; Svrček, 1958).

I have studied a part of the holotype which contains 3 pieces of larch needles with 3 young, not fully mature fruit-bodies. All characters are as presented above. I find the spores narrower than Svrček, who reported them to 5 µm wide (K= 2.7), and I have not observed the yellow contents of the paraphyses as originaly described. Apothecia on *Carex flacca* subsp. *claviformis*, as reported in original description, were not available in this portion of the holotype.

According to the examination of holotype, I conclude that *Helotium tatrae* is a distinct member of *Hymenoscyphus* and seems to be allied to *H. epiphyllus*.

Hymenoscyphus virgultorum (Wiggers) Phillips, Brit. Discom. p. 134, 1887.

≡ *Peziza virgultorum* Wiggers, Prim. Fl. Holosat. p. 106, 1780.
≡ *Peziza fructigena* Bull. : Fr. b. *virgultorum* (Wigg.) Fries, Syst. Mycol. 2:118, 1822.
≡ *Helotium virgultorum* (Wigg.) Fries, Summa Veg. Scand., Secr. Post., p. 355, 1849.
≡ *Phialea virgultorum* (Wigg..) Saccardo, Syll. Fung. 8:266, 1889.
≡ *Helotium fructigenum* (Bull. : Fr.) Gill. * *H.virgultorum* (Wigg.) P. Karsten, Acta Soc. Fauna Fl. Fenn. 2:125, 1885.
= *Phialea ampla* Ellis & Everhart, Bull. Torrey Bot. Cl. 24:135, 1897.
= *Helotium conscriptum* (P. Karst.) P. Karst. f. *caulicolum* Rehm, Hedwigia

24:228, 1885.

= *Peziza conscripta* P. Karsten, Fungi Fenn. Exsic. no. 638, 1867.

≡ *Helotium conscriptum* (P. Karst.) P. Karsten, Not. Sällsk. Fauna Fl. Fenn. 11:236, 1871.

≡ *Helotium sublenticulare* (Hornem.) P. Karst. * *conscriptum* (P. Karst.) P. Karsten, Mycol. Fenn. 1:119, 1871.

≡ *Calycella conscripta* (P. Karst.) O. Kuntze, Rev. Gen. Pl. 3(2):448, 1898.

≡ *Hymenoscyphus conscriptus* (P. Karst.) Korf in Kobayasi & al., Ann. Rep. Inst. Fermentation (Osaka) 3:55, 1967.

= *Helotium mali* Velenovský, Monogr. Discom. Boh. 1:187, 1934.

= *Peziza salicella* Lasch in De Notaris, Comment. Soc. Crittog. Ital. 1(5):382, 1864; [non *Peziza salicella* Fries, Syst. Mycol. 2:133, 1822; = *Hymenoscyphus salicellus* (Fr.) Dennis].

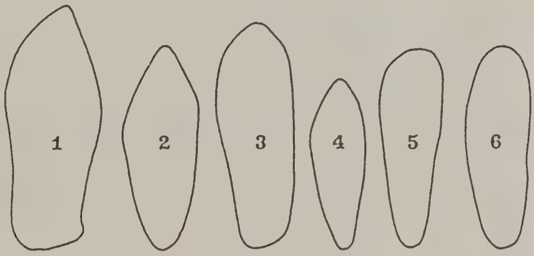
= *Helotium septatum* Velenovský, Novit. Mykol. Novis. p. 120, 1947.

= *Helotium spinosae* Velenovský, Novit. Mykol. Novis. p. 119, 1947.

Missapl. *Peziza calyculus* Sowerby, Engl. Fungi. tab. 116, 1797; Fries, Syst. Mycol. 2:129, 1822.

≡ *Phialea calyculus* (Sow. :Fr.) Gillet, Champ. France Discom. p. 108, 1881.

≡ *Hymenoscyphus calyculus* (Sow. : Fr.) Phillips, Brit. Discom. p. 136, 1887.



Ascospores of *H. virgultorum*: 1. BRA, Biele Karpaty Mts.; 2 - 3. PRM 614216; 4. CUP, Mycoth. Germ. no. 601; 5. NY, Ascomyceten no. 2123; 6. CUP, Fungi Sel. Exsic. no. 211. x2000.

Apothecia golden yellow when fresh, ochre-yellow to reddish-brown when dry, towards the margin paler, 0.5 - 2(5) mm diam., long stipitate, cupulate, scattered. Disc concave, yellow. Receptacle paler, minutely downy. Stipe cylindric, finely downy, usually as long as the diameter of the receptacle, 0.5 - 3(4.5) x 0.5 mm. Ectal **excipulum** of textura porrecta, composed of cells 30 x 5-10 µm. Medullary excipulum of textura porrecta in the stipe, composed of cells, 3 - 4 µm diam., towards the subhymenium of isodiametric or nearly globose cells. **Asci** cylindric, conical at the apex, pore blue in Melzer's reagent, 120-130 x 6.5-12 µm. **Paraphyses** filiform, slightly enlarged at the apex, 2.5 - 3 µm diam. **Ascospores** uniseriate or irregularly biseriate, ellipsoid to inequilateral (naviculate), rounded at the proximal end and tapered towards the distal end, non-septate, (12.6)13.0-15.7(19.4) x (3.7)4.1-5.1(6.0) µm, K= 3.5. **Anamorph** unknown. Berthet (1964b) obtained only a sterile mycelial culture.

ILLUSTRATIONS: Vahl (1790), Sowerby (1797), Dennis (1956, 1960, 1968, 1978), Seaver (1951), Bellemère (1967), Svrček (1985); this paper.
HABITAT: On twigs and trunks of broad-leaved trees: *Acer pseudoplatanus*, *Aesculus* sp., *Alnus glutinosa*, *A. incana*, *A. viridis*, *Alnus* sp., *Carpinus* sp., *Corylus* sp., *Fagus sylvatica*, *Fraxinus excelsior*, *Ilex* sp., *Quercus ilex*, *Quercus* sp., *Ribes laxifolium*, *Salix cinerea*, *Salix* sp., *Sarothalmus* sp., *Skimmia laureola*, *Sorbus aucuparia*, *Vitis vinifera*.
DISTRIBUTION: ***Europe***: Austria, Czechoslovakia (Slovakia, Bohemia), Estonia, Finland, France, Germany, Great Britain, Poland, Russia, Switzerland. ***Asia***: Pakistan. ***Africa***: Morocco. ***North America***: U.S.A. ***South America***: Venezuela. **Slovakia**: Biele Karpaty Mts. (7172), Nízke Tatry Mts. (7083); Malé Karpaty Mts.: (7868) *Corylus* & *Carpinus*, Calvarienberg [the hill Kalvária in Bratislava] (Bäumler, 1897); Nízke Tatry Mts.: (7083) *Salix* sp., Srdiečko [on the foot of the hill Chopok], (Svrček, 1962); Košická kotlina Basin: (7093) Eperjes [near Prešov] (Hazslinszky, 1886); Biele Karpaty Mts.: Trencsén [near Trenčín] (Hazslinszky, l. c.); Oravské Beskydy Mts.: (6483) Wążowiec [the hill Vonžovec], Bukowy Groń [hill Bukový Grúň], (Bujakiewicz, 1979).
SPECIMENS EXAMINED: ***Europe***: **Czechoslovakia, Slovakia**: Biele Karpaty: (7172) ad lignum *Fagi sylv.* in rivo in clivo sept.-orient. mont. Javorník prope pag. Moravské Lieskové - Šance, 450 - 500 m, 18.X.1978, P. Lizoň (BRA); Nízke Tatry: (7083) in valle rivi Bystry potok infra Srdiečko [on the foot of the hill Chopok], ad truncum musc. *Fagi sylv.*, cca 1150 m, 6.IX.1960, J. Kubička (PRM 614214, 614216); (7083) Trangoška (Srdiečko) [on the foot of the hill Chopok], ad truncum iac. *Fagi sylv.*, 1200 m, M. Svrček (PRM 614215; Svrček, 1962). **Czechoslovakia, Bohemia** merid.: Třeboň, in pratis uliginosis Mokré louky, Ad ramos truncosque deiectos *Salicis cinereae*, 20.X.1079, J. Kubička (CUP, Svrček, Fungi Sel. Exsic. no. 21). **Finland**: Mustalia, på *Salix*, X. (FH, Karsten, Fungi Fenn. Exsic. no. 638, 1867). **Germany**: An *Acer pseudoplatanus* zwischen Moos, Tamsel, Brandenburg, Vogel (NY, Rehm, Ascomyceten no. 2123, 1914); Auf faulenden Aesten von *Salix cinerea*, Mark Brandenburg: Buch bei Bernau, 25.XI.1906, H. Sydow (CUP, Sydow, Mycoth.. Germ, no. 601, 1907). **Great Britain**: On twigs of *Salix* sp., Thorton Narishes Pickering, Yorkshire (England), 11.IX.1956, W. G. Bramley (CUP-G 1060). ***North America*: U.S.A.**: On dead grape vines, Nuttalburg, West Va., X.1894, L. W. Nutall (CUP, Ellis & Everhart, North Amer. Fungi no. 3232, 1895); On dead branches of *Salix* sp., Mt. Paddo [Washington], at about 7000 ft., 17.,18.IX.1894, A. N. Sukdorf (FH, holotype of *Phialea ampla*).

Wiggers (1780) introduced the name *Peziza virgultorum* for a stipitate yellowish fungus growing on wood. The species has long been known as *Helotium calyculus* (Sow. : Fr.) Fr. *Peziza virgultorum* is the oldest validly published name for the fungus described here which agrees with *Helotium calyculus* in the sense of Dennis (l. c.). Since the holotype of *Peziza calyculus* represents a member of Sclerotiniaceae, *Hymenoscyphus virgultorum* (Wigg.) Phill. is the earliest available name for this taxon.

The name *Helotium virgultorum* has been used frequently but the concept of this species was misinterpreted. For example, the specimens by Hazslinszky at BP treated under this name are conspecific with *H. scutulus*. Dennis (1956) referred *Helotium virgultorum* to the synonymy of *Helotium calyculus* and it is not clear if he examined the holotype of Wiggers's species. I have not examined the holotype and Carpenter (1981) was also not able to locate any type material. A neotype should probably be selected.

Sowerby (1797) described his *Peziza calyculus* as a species which "differs but little from *Peziza ochroleuca*." Dumont & Carpenter (1982) have studied the holotype of *Peziza calyculus* at K and decided it agrees in all aspects with *Rutstroemia firma*. I am not sure that they have examined the same specimen as Dennis (l. c.), the collection on *Corylus* host (determination by Metcalf). Dennis (l. c.) found ectal excipulum composed of thin-walled elongated cells and Dumont & Carpenter (l. c.) reported the excipulum as forming textura porrecta with the hyphae immersed in a gel. I follow the conclusions\of Dumont & Carpenter.

The description and delimitation of *H. calyculus* by Dennis (l. c.) enable us to distinguish this species from a *Hymenoscyphus serotinus* - *H. caudatus* complex. Some authors missed the point and, for example, Breitenbach & Kränzlin (1981) identified *Hymenoscyphus serotinus* as *H. calyculus* "according to Dennis."

Dennis (l. c.) has examined original material (? the type) of *Peziza conscripta* P. Karsten and considered it to be a form of *H. calyculus* on *Salix*. He reported "the pore plug not now blued by Melzer's reagent." I have examined the isotype at H and find the pore, in accordance with Karsten (1869) "obturaculo levissime coerulente", blue in Melzer's reagent and I treat it as conspecific with *H. virgultorum*. A specimen at NY, labeled as *Helotium calyculus* (U.S.A.: on rotted wood on edge of swamp Ringwood Preserve, 22.VII.1965, K. P. Dumont), is a different taxon. It is probably the same as *Hymenoscyphus salicellus*.

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OIDIOPSIS THRYALLIDIS SPEC. NOV.

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Thryallis glauca (=*Galphimia gracilis*; = *G.glauca*) (Malphigiaceae) is commonly grown in gardens as a bush or as borders for their attractive yellow flowered inflorescences. The small light green leaves were seen spotted with reddish brown, diffuse spots, in winter, the underside of which showed powdery mildew growth with diffused whitish to greyish fungal colonies. There was no record of powdery mildew fungi on any of the members of the F.Malphigiaceae. The present collection of powdery mildew fungus with internal mycelium and conidia not produced in chains, was identified as an undescribed species of *Oidiopsis*. It differs from the conidial *Leveillula taurica* and other related taxa in possessing primary conidia characteristically clavate in shape. Hence the collection at hand is described here as :

Oidiopsis glaucae sp. nov. (Fig. 1).

Spots amphiphyllous, reddish-brown, diffused, without distinct margin on upper leaf surface and with whitish-greyish powdery growth on the lower leaf surface, upto 5-15 mm in diam. Mycelium internal. Conidiophores emerging through stomata in groups of 3-5, erect, long, slender 160 - 250 µm. Conidiogenous cells terminal. Conidia hyaline, single, cylindrical-clavate, (primary conidia clavate), apex subacute, 56 - 70 x 10 - 17.5 µm.

Collected on living leaves of *Thryallis glauca* Kuntz, (= *Galphimia gracilis* Bartling; = *G. glauca* Cav.) (Malphigiaceae); at M.A.C.S.campus; dt. 29th Oct.,1991; leg. V. G. Rao & A. Pande; AMH 7584 (Holotype).

Maculae infectionis amphiphyllae, supra rubro-brunneae, diffusae, infra griseo-albae; 5-15 mm in diametro; mycelium immersum, intercellularum; conidiphora emergentia ex stomata hypophylla, 3-5, recta, 160 - 250 µm longa. Conidiogeno cellulo apico; conidia hyalina, cylindrica, clavata, ad apicem subacutea, 56 - 70 x 10 - 17.5 µm.

In foliis *Thryallis glauca* Kuntz, (Malphigiaceae); 29.X.1991, Loco: Poona, Leg. V. G. Rao & A. Pande, AMH 7584 (Holotypus).

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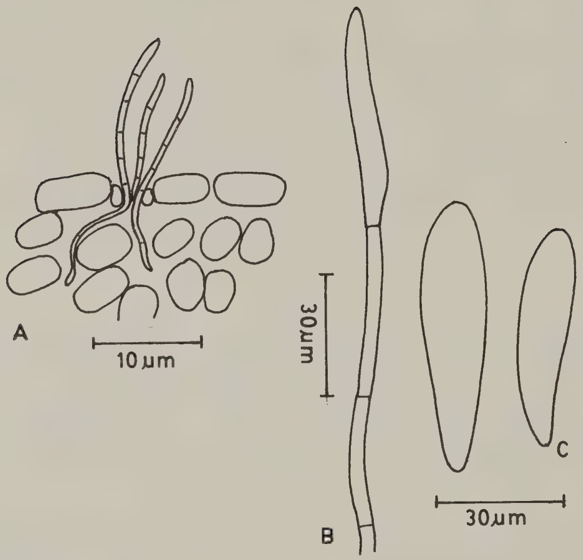

Fig. 1

Fig.1. *Oidiopsis thryallidis* Pande & Rao
A: conidiophores emerging through stoma; B: conidiophore; C: conidia

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THE TAXONOMIC SIGNIFICANCE OF EXTRACELLULAR DEOXYRIBONUCLEASE ACTIVITY AMONG SPECIES OF ECTOMYCORRHIZAL FUNGI

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ABSTRACT

Seventy three isolates of ectomycorrhizal fungi representing 65 species were examined for extracellular deoxyribonuclease activity on modified DNase test agar 7, 12, 15 and 21 weeks after inoculation. All members of the Boletales _sensu_ _lato_ (_Boletellus_, _Boletus_, _Leccinum_, _Paxillus_, _Rhizopogon_, _Scleroderma_, _Strobilomyces_, _Suillus_ and _Xerocomus_) and species of the genus _Amanita_ exhibited no DNAse activity. Most members of the Cortinariaceae (_Cortinarius_ and _Hebeloma_) were strongly positive. In the Russulaceae (_Lactarius_ and _Russula_) and Tricholomataceae (_Laccaria_ and _Tricholoma_), some species were negative while others became positive after long incubation periods. The enzymatic ability to degrade DNA has potential as a taxonomic character within an integrated approach to the identification of ectomycorrhizal fungi in axenic culture.

INTRODUCTION

Axenic cultures of saprotrophic and ectomycorrhizal Hymenomycetes are notoriously difficult to differentiate and identify when traditional morphological characters are exclusively relied upon. Thus, researchers such as Nobles (1958) and Stalpers (1978) placed emphasis upon the importance of biochemical characters, such as polyphenol oxidase activity, as a means by which to identify isolates. Taylor (1974), and more recently Klan _et_ _al_. (1989), Thorn (1991), Hutchison (1990a, 1990b, 1990c, 1990d, 1991), and Hutchison and Summerbell (1990) among others, investigated the feasibility of using other biochemical and physiological characters to augment morphological traits in the investigation of taxonomic relationships among cultures of the Hymenomycetes. Such an approach has been successfully employed among the bacteria (Buchanan and Gibbons, 1974) and yeasts (Barnett _et_ _al_., 1983) where a paucity of morphologically useful taxonomic characters exist. Among the characters employed for the identification of these latter single-celled organisms has been the detection of extracellular DNase activity.

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The present study was undertaken to see if extracellular DNase activity in cultures of ectomycorrhizal fungi could be used successfully as a potential taxonomic character for their differentiation.

MATERIALS AND METHODS

With the exception of the Cenococcum geophilum strain which was isolated from serially washed mycorrhizal root tips, isolates of ectomycorrhizal fungi were cultured from tissue aseptically derived from the interior of fresh basidiomata. These tissue pieces were placed on modified BAF agar (Hutchison, 1991) supplemented with 2 mg/L of chlortetracycline hydrochloride (Sigma Chemical Co.), 30 mg/L of streptomycin sulphate, and 2 ug/L of benomyl (Benlate, 50% wettable powder, Du Pont Co.). These cultures have been deposited into the University of Alberta Microfungus Collection (UAMH), with dried basidiomata and notes deposited into the University of Toronto Cryptogamic Herbarium (TRTC). Additional isolates were obtained from UAMH and the Centre de recherche en biologie forestière, Université Laval (CRBF).

Because of the relative sensitivity of basidiomycetes to levels of sodium chloride (5g/L) present in commercially prepared DNase test agar (Difco), a modified medium was prepared that was suitable for the growth of fastidious ectomycorrhizal fungi. Fibres of deoxyribonucleic acid (sodium salt type III from salmon testes, Sigma Chemical Co., Cat. No. D-1626) were physically cut with scissors and dissolved in distilled water at a rate of 2g/L utilizing a stirbar and hotplate set at a lukewarm setting. After several hours the solution became somewhat glutinous and was then sonicated in small batches for several minutes duration each until the total volume was homogenized. Ingredients for modified Melin-Norkrans agar (Hutchison, 1991) were added to the resulting solution, with the quantity of glucose reduced to 1 g/L (as starter sugar). Utilizing the method of Smith et al. (1969), a 0.5% aqueous solution of methyl green (BDH Chemicals Ltd.) was made up and repeatedly extracted with approximately equal volumes of chloroform until the chloroform was colourless. Before the DNase test agar was to be autoclaved, 10 mL of the dye solution was added per litre. After autoclaving, the agar was poured into standard plastic Petri plates (90 mm) and allowed to solidify. For each isolate, plates were inoculated in triplicate with a single 4 mm disc (using No.1 cork borer), with mycelium of the inoculum piece in contact with the agar surface. Plates were incubated at 18-20°C in the dark and readings made weekly. Extracellular DNase activity will be detected by a clear zone around and below each colony in an otherwise green background.

RESULTS

All members of the Boletales tested were found to be negative for the degradation of DNA (Table 1). This assemblage of fungi included not only species within the typically boletoid genera of Boletellus, Boletinus, Boletus, Leccinum, Strobilomyces, Suillus, and Xerocomus, but also the lamellulate Paxillus involutus and species in the related gasteromycetous genera of Scleroderma and Rhizopogon. Species of Amanita (Amanitaceae) likewise were all negative for extracellular DNase activity, even after 21 weeks.

TABLE 1. Detection of extracellular deoxyribonuclease activity in cultures of ectomycorrhizal fungi.

Taxa examined	cultural isolates	7 weeks	12 weeks	15 weeks	21 weeks
Amanita citrina (Schaeff.: Fr.) Pers.	CRBF 111	-	-	-	-
Amanita flavoconia Atk.	CRBF 109	-	-	-	-
Amanita muscaria (L.:Fr.) Pers.	UAMH 5637	-	-	-	-
	UAMH 5822	-	-	-	-
Amanita rubescens (Pers.: Fr.) Pers.	UAMH 6143	-	-	-	-
Boletellus russellii (Frost) Gilbert	UAMH 5938	-	-	-	-
Boletinus cavipes (Opat.) Kalchbr.	UAMH 6144	-	-	-	-
Boletus ornatipes Peck	UAMH 6056	-	-	-	-
Cenococcum geophilum Fr.: Fr.	UAMH 6146	-	+	+	+
Cortinarius allutus Fr.	UAMH 5474	+(w)	+	+	+
Cortinarius amoenolens R.Henry	UAMH 5534	-/+(w)	-/+(w)	-/+(w)	+
Cortinarius anomalus (Fr.: Fr.) Fr.	UAMH 5929	-	-	-	-
Cortinarius brunneus (Pers.: Fr.) Fr.	UAMH 5793	+	+	+	+
Cortinarius glaucopus (Schaeff.: Fr.) Fr.	UAMH 5558	+	+	+	+
Cortinarius mucosus (Bull.: Fr.) Fr.	UAMH 5837	-	-	-	-
Cortinarius subpurpurascens (Batsch) Fr.	UAMH 6195	+	+	+	+
Hebeloma crustuliniforme (Bull.) Quél.	UAMH 5251	-	-/+(w)	+(w)	+
	UAMH 5460	+	+	+	+
Hebeloma cylindrosporum Romagn.	CRBF 38	-	-	-	-
Hebeloma longicaudum (Pers.: Fr.) Kummer	UAMH 6064	+	+	+	+
Hebeloma mesophaeum (Pers.) Quél.	CRBF 99	-/+(w)	-/+(w)	-/+(w)	+
Hebeloma velutipes Bruchet	CRBF 116	-/+(w)	-/+(w)	+(w)	+
Laccaria bicolor (R.Maire) Orton	UAMH 5268	-	-	-	-
	UAMH 5476	-	-	-	-
	UAMH 6061	-	+	+	+
Laccaria laccata (Scop.: Fr.) Berk. & Br.	UAMH 6063	+(w)	+	+	+
Laccaria ochropurpurea (Berk.) Peck	UAMH 5814	-	-	-	-
Laccaria proxima (Boud.) Pat.	UAMH 6062	-	-	-	-

TABLE 1. continued.

Taxa examined	cultural isolates	7 weeks	12 weeks	15 weeks	21 weeks
Lactarius affinis Peck	UAMH 6078	-	-	-	-
Lactarius chelidonius Peck	UAMH 6197	+(w)	+(w)	+(w)	+
Lactarius deliciosus (L.: Fr.) S.F.Gray	UAMH 5839	-/+(w)	-/+(w)	-/+(w)	+
	UAMH 6079	+(w)	+	+	+
Lactarius indigo (Schw.) Fr.	UAMH 5933	-/+(w)	-/+(w)	-/+(w)	-/+(w)
Lactarius mucidus Burl.	UAMH 6076	-	-	-	-
Lactarius pubescens (Schrad.) Fr.	CRBF 118	-/+(w)	-/(w)	+	+
Lactarius rufus (Scop.: Fr.) Fr.	UAMH 5797	-	-	-	-
	UAMH 5836	-	-	-	-
Lactarius subpurpureus Peck	UAMH 5926	-	-	-	-
Lactarius thejogalus (Bull.: Fr.) S.F.Gray	UAMH 5920	-	-	-	-
Lactarius thyinos A.H.Smith	UAMH 5840	-	+(w)	+	+
Lactarius torminosus (Schaeff.: Fr.) S.F.Gray	UAMH 5815	-/+(w)	-/+(w)	+	+
Lactarius vinaceorufescens A.H.Smith	UAMH 5835	-	-	-	-
	UAMH 5841	-	-	-	+
Leccinum arenicola Redhead & Watling	UAMH 5927	-	-	-	-
Leccinum aurantiacum (Bull.) S.F.Gray	UAMH 5921	-	-	-	-
Leccinum holopus (Rostk.) Watling	UAMH 5932	-	-	-	-
Paxillus involutus (Batsch: Fr.) Fr.	UAMH 5817	-	-	-	-
Rhizopogon rubescens (Tul.) Tul.	UAMH 5190	-	-	-	-
Rhizopogon superiorensis A.H.Smith	CRBF 104	-	-	-	-
Rhizopogon vinicolor A,H.Smith	UAMH 6200	-	-	-	-
Russula subfoetens W.G.Smith	UAMH 5823	-	-/+(w)	-/+(w)	-/+(w)
Russula velenovskyi Melzer & Zvara	UAMH 6073	-	-	-	-
Scleroderma bovista Fr.	UAMH 6202	-	-	-	-
Scleroderma citrinum Pers.: Pers.	UAMH 5935	-	-	-	-
Strobilomyces floccopus (Vahl.: Fr.) Karst.	LH-17-86	-	-	-	-

TABLE 1. continued.

Taxa examined	cultural isolates	7 weeks	12 weeks	15 weeks	21 weeks
Suillus americanus (Peck) Snell	UAMH 5934	–	–	–	–
Suillus grevillei (Kl.: Fr.) Singer	UAMH 5924	–	–	–	–
Suillus neoalbidipes Palm & Stewart	UAMH 6158	–	–	–	–
Suillus ochraceoroseus (Snell) Singer	UAMH 5286	–	–	–	–
Suillus sinuspaulianus (Pomerleau & A.H.Smith) Dick & Snell	UAMH 6147	–	–	–	–
Suillus spectabilis (Peck) Singer	UAMH 6148	–	–	–	–
Suillus tomentosus (Kauffman) Singer, Snell & Dick	UAMH 5795	–	–	–	–
Tricholoma aurantium (Schaeff.: Fr.) Ricken	UAMH 5497	–	–	–	–
Tricholoma cingulatum (Ahnfelt) Jacobasch	CRBF 112	–	–/+(w)	+	+
Tricholoma fulvum (DC.: Fr.) Sacc.	UAMH 6206	–	–	–	–
Tricholoma myomyces (Pers.: Fr.) Lange	UAMH 5936	–	–	+(w)	+
Tricholoma populinum Lange	CRBF 91	–	–	–	+
Tricholoma resplendens (Fr.) Karst.	UAMH 5799	–/+(w)	–/+(w)	–/+(w)	+
Tricholoma vaccinum (Schaeff.: Fr.) Staude	UAMH 5498	–	–	–	–
	UAMH 5502	–	–	–	–
Tricholoma virgatum (Fr.: Fr.) Kummer	UAMH 5798	–	–	–	–
Xerocomus badius (Fr.) Kühner ex Gilbert	UAMH 5813	–	–	–	–
Xerocomus subtomentosus (L.: Fr.) Quél.	UAMH 5818	–	–	–	–

NOTE: (–) negative; [+(w)] weak positive; (+) positive.

Members of the Cortinariaceae on the other hand, which included species of *Cortinarius* and *Hebeloma*, tended to produce fairly broad zones of clearing around each colony by week 7, thus indicating strong extracellular DNase activity. This was particularly true of *Hebeloma longicaudum*, *H. crustuliniforme* (UAMH 5460), *Cortinarius brunneus*, *C. glaucopus* and *C. subpurpurascens*. Only *Cortinarius anomalus*, *C. mucosus* and *Hebeloma cylindrosporum* remained negative even after 21 weeks. The remaining species exhibited a very weak clearing at first but ultimately a strong positive reaction was recorded.

Cenococcum geophilum was negative initially, but by week twelve extracellular DNase was detected. Species within the Tricholomataceae (*Laccaria* and *Tricholoma*) and Russulaceae (*Lactarius* and *Russula*) were variable, most species lacking extracellular DNase activity. But some such as *Lactarius thyinos* and *Tricholoma cingulatum* became positive by 21 weeks.

DISCUSSION

The patterns of extracellular DNase activity observed among isolates of ectomycorrhizal fungi tested was generally consistent within taxonomically recognizable groups. Testing this ability therefore has potential as an aid in taxonomic determination. Hutchison (1991) recently summarized other cultural characters found to be useful for the identification of cultures of ectomycorrhizal fungi including selective sensitivity to certain fungitoxic compounds, laccase and tyrosinase activity, and degradation of selected carbon and nitrogen compounds.

Extracellular DNase activity has previously been used as a character for the differentiation of *Serratia* from other gram-negative bacteria within the Enterobacteriaceae (Rothberg and Swartz, 1965; Valu, 1966). These authors found that species in the former were positive while those in the latter were negative. Cazin *et al*. (1969) and Sen and Komagata (1979) found that basidiomycetous yeasts as well as biologically related species in the genera *Rhodotorula*, *Cryptococcus* and *Candida* were positive for DNase activity compared with their ascomycetous counterparts which failed to exhibit activity. Taylor (1974) previously showed that extracellular DNase activity had taxonomic potential for the identification of mycelial cultures of basidiomycetes. He found that *Peniophora sacrata* G.H.Cunn. and *Sclerotium rolfsii* Sacc. were negative for extracellular DNase activity while *Stereum purpureum* (Fr.) Fr. and *Trametes versicolor* (L.: Fr.) Pilat were positive.

However, no character alone is sufficient for the identification of an unknown isolate of an ectomycorrhizal fungus. Each species in axenic culture requires a set of key characters to circumscribe its generic affinity followed by secondary characters to determine its species identity (Hutchison, 1991). It is hoped that the results from this paper are sufficiently convincing that extracellular DNase activity will be considered as a further useful character to those already in use.

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Dr. Richard C. Summerbell (Medical Mycology Laboratory, Ontario Ministry of Health, Toronto) kindly reviewed the manuscript. Financial support was provided by a Natural Sciences and Engineering Research Council of Canada (NSERC) postgraduate scholarship to the author and by an NSERC operating grant (A0145) to Dr. David Malloch in whose laboratory this work was undertaken.

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ANTHINA FLAMMEA (AGONOMYCETES) - AN ENIGMATIC FUNGUS

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ABSTRACT: *Anthina flammea* is described in detail with special emphasis on the features observed in vital specimens and cultivated material.

KEYWORDS: Agonomycetes, *Anthina*, *Cordyceps*, Mycelia sterilia.

1. Introduction

The Deuteromycetes are known to be a very large, heterogenous group, which comprise anamorph states of ascomycetes, more rarely basidiomycetes. They have either lost their teleomorph or very rarely produce their teleomorph. The "Mycelia sterilia" or "Agonomycetes" comprise a small group of ca. 28 genera within the Deuteromycetes with about 200 species (HAWKSWORTH et al. 1983). They lack any conidia or produce only chlamydospores (WATLING 1979).
One of them is *Anthina flammea* Jungh.: Fr., type species of the genus *Anthina* Fr.: Fr., which seems to be widely distributed in Europe. FRIES (1832) described eight species of *Anthina*, but these descriptions are based only on macroscopical features and leave some doubt on the natural

delimitation of the taxa. Recently, the authors succeded in obtaining cultures of *Anthina flammea* from pseudocarpophores, growing in an oak forest on decaying leaves of *Fagus sylvatica* and *Quercus robur*. Therefore, an attempt has been made to characterize the fungus, on the basis of vital collections und cultivated material. The pseudocarpophores are strongly pigmented, which suggested the possibility of a characterization by thin layer chromatography.

2. Material and methods

The cultures were characterized by growing them on four different agar media: Moser b, MMN (MARX 1969), YM agar and wort agar (Merck 5448). The cultures were inoculated with a square (0.5 cm x 0.5 cm) piece from the margin of a growing culture and checked every week. Three plates of each medium were used.

An enzymatic reaction with gum guajac and syringaldazine (HARKIN et al. 1974) could not be observed due to the strong, soluble pigmentation of the fungus which interferes with the stains. Therefore, enzymatic reactions were tested by inoculation of the cultures on tannic acid agar (DAVIDSON et al. 1938).

Microchemical characters were prepared by squashing pieces of the fungus, growing on agar, in a variety of chemicals and observed under a microscope after 5 minutes. Chemicals used include Brillant Cresyl Blue, $FeSO_4$, KOH, lactic acid, Lactophenol Cotton Blue, Melzer's reagent, NH_4OH, phenol, Sudan Black, Sudan IV, sulfovanillin, and sulfuric acid.

Nuclear behavior of the fungus in culture was observed by staining in bisbenzimide (0.1 % solution in H_2O) for 5 minutes and observing under a Leitz fluorescence microscope using a wavelength of 360 nm. A possible autofluorescence of the cultures was checked with a UV lamp (254 nm, 366 nm).

Dried specimens of the fungus were observed under a fluorescence microscope in KOH and lactic acid using a wavelength of 360 nm, 470 nm, and 545 nm respectively. Thin layer chromatography was carried out with Merck plates, silica gel 60 F, MERCK no. 5715 (solvent A - toluene:ethyl formiate:formic acid = 5:4:1; solvent B -benzene:ethyl formiate:formic acid = 10:5:3).

Herbarium material of HAL, K, M, and UPS was studied. The numbers in brackets behind each specimen refer to the analyses numbers of the authors.

Strains of the cultivated material will be deposited with the Centraalbureau voor Schimmelcultures, Baarn (CBS).

3. Results

3.1. Nomenclature and characterization of Anthina flammea

Anthina Fr.: Fr., Syst. Mycol. 3(2): 281 (1832) - [nomen anamorphosis]. ≡
Anthina Fr. Novit. Fl. Suec., Partic V. Cont.: 79 (1819) - [nom.inval. - according to ICBN 1988: art. 13.1 (d.)].
Type: *Anthina flammea* Fr. - lectotype, selected in CLEMENTS & SHEAR 1931: 410.

Anthina flammea Jungh.: Fr., Syst. Mycol. 3 (2): 283 (1832).
≡ *Himantia flammea* Jungh., Linnaea 5: 408 + tab. 7, fig. 4 (1830). - [nom.inval. - according to ICBN 1988: art. 13.1 (d.)].
Type: "*Himantia* species nova", [no locality, no date, no collector] (HAL! - holotype). "In sylvis Hercyniae frondosis, im Wipperthal, Sept." - according to the protologue.

3.1.1. Characters of the fungus from nature

Description (based on herbarium material and vital collections): *Mycelium*: growing as an irregular reddish-orange hyphal mat on decaying leaves of *Quercus robur* L., *Fagus sylvatica* L., *Betula pendula* Roth, and (?) *Populus tremula* L. These mats are connected to each other by hyphal rhizomorphs. Individual mats give rise to reddish-orange, clavarioid pseudocarpophores (fig. 1), occuring from September until November. *Pseudocarpophores*: reddish-orange, up to 30 mm tall, with forked tips, made up of bundles (mostly up to 1.5 mm, rarely more mm diam.), of parallel, undifferentiated hyphae.

Hyphae: monokaryotic, 2.5-7.0 µm diam., rarely septate; ramifications scarce. Length of hyphal cells ca. 20 - 60 µm, clamp connections lacking; dolipores not recognizable in LM. Hypha-peg anastomoses present. Cell content orange to reddish brown (in H_2O). Pigment vacuolar. Hyphal surface occasionally incrusted by crystal depositions, visible in NH_4OH, but not in KOH, where they apparently dissolve. Walls either thin or sometimes conspicuously thick (up to 1.5 µm).

Spores / conidia: not observed.

Chemical reactions: $FeSO_4$ -; Lactic acid -; NH_4OH: orange-brown, pigment soluble; KOH: orange to yellow, pigment soluble; I_{Melzer} -.
T.l.c.: Unknown pigment P (solvent A: R_f 0.33, solvent B: R_f 0.29; daylight: red-violet; UV_{350}: violet) - often in low concentrations or lacking. Unidentified unspecific substance F1 (solvent A: R_f 0.63, solvent B: R_f 0.65; daylight: colorless; UV_{350}: yellow) - as major or minor substance.
Unidentified unspecific substance F2 (solvent A: R_f 0.50, solvent B: R_f 0.50; daylight: colorless; UV_{350}: yellow) -as major or minor substance.

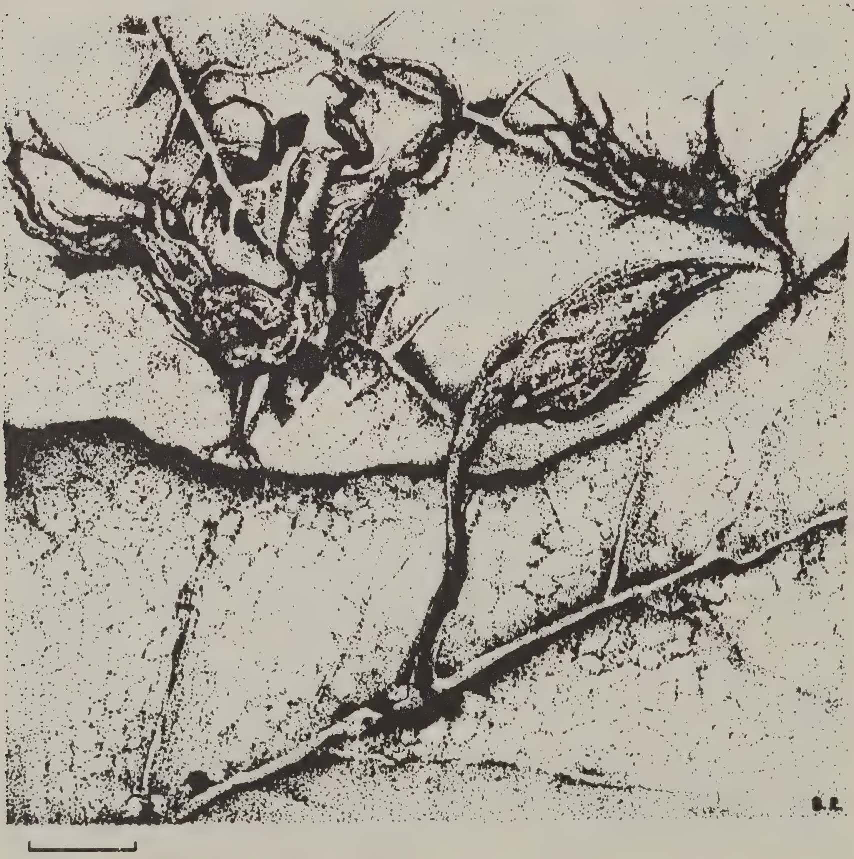

Fig. 1: *Anthina flammea* (habitus) on decaying leaves of *Fagus sylvatica* (*G. Rambold* 5793, M). – Scale: 2 mm.

3.1.2. Characters of the cultivated fungus

Four different inoculation media were used: YM, wort, MMN, and Moser b. On all media the mycelium grew more or less extensively on the surface. Submerged growth could be observed, but was not very abundant. The appearance of the cultures was examined 1) after 7 days, 2) after 15 days, and 3) after 29 days.

YM agar:
1) Mycelium fluffy, margins bright red, with distinct yellow exudate; reverse orange red.
2) Mycelium dense, fluffy, with greenish tinges, with yellow exudate; reverse reddish.
3) Mycelium very dense, fluffy, central zone greenish, margin orange reddish, yellow exudate; reverse dark brown.
Growth rate of the cultures: 1.8 cm in 4 weeks.

Wort agar:
1) Mycelium fluffy, margin bright red, yellow exudate, however less distinct than on YM; reverse orange red.
2) Mycelium dense, fluffy, almost cottony, reddish-orange like the free-living fungus; reverse reddish.
3) Mycelium dense, fluffy, with irregular cottony patches of orange color like in the free-living state; margin brighter than central zone; reverse dark brown.
Growth rate of the cultures: 3.4 cm in 4 weeks.

MMN:
1) Mycelium fluffy, outermost margin whitish, center bright red; with few yellow exudate; reverse orange red.
2) Mycelium dense, fluffy, of reddish color, mixed with a dark green tinge, yellow exudate pale; reverse reddish. 3) Mycelium dense, fluffy, central zone green, very center dark green, becoming paler towards the margin; very margin reddish; reverse dark brown.
Growth rate of the cultures: 2.8 cm in 4 weeks.

Moser b:
1) Mycelium fluffy, color light orange, lighter than on YM, Wort and MMN, without any differently colored marginal zone; no exudate; reverse orange red.

2) Mycelium less dense than on the other media, fluffy, orange reddish; no exudate; reverse reddish; distinct aerial mycelium developed.
3) Mycelium with dark brown central zone (2/3), covered with sparse, cottony, whitish surface mycelium; margin whitish to cream, fluffy; no exudate; reverse dark brown with whitish margin.
Growth rate of the cultures: 3.7 cm in 4 weeks.

A positive reaction (brown staining) of tannic acid agar showed that extracellular oxidases are present. It was impossible to observe reactions with gum guajac and syringaldazine due to a strong brown pigment of the cultures which immediately dissolved in ethanol being the carrier of the test spot reagents. Mycelium growing in petri dishes did not fluoresce under UV light (254 nm, 366 nm), and autofluorescence could not be observed under a fluorescence microscope in KOH and lactic acid (360 nm, 470 nm, 545 nm).

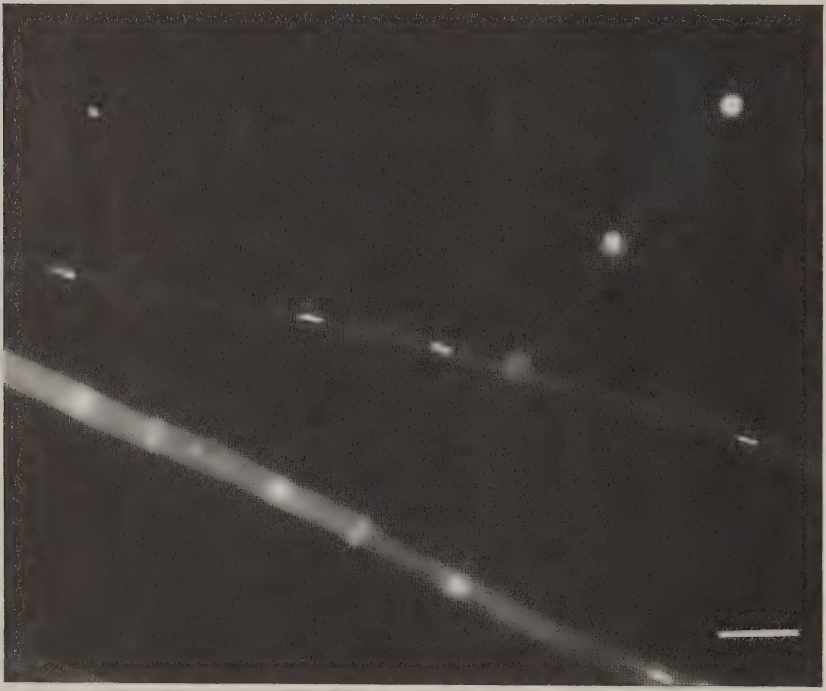

Fig. 2: Nuclear staining of *Anthina flammea* (*G. Rambold* 5793, M). – Scale: 10 µm.

Hyphae growing in culture were 1-3.5 µm in diam.; the cell wall was not conspicuously thick. Many oleiferous hyphae were present, with mostly yellow or occasionally with brown contents. Few hyphal swellings were observable (diam. up to 6 µm). Occasionally hyphae showed crystaloid incrustations. Clamp connections were not observed.

Microchemical reactions: Brillant Cresyl Blue -; $FeSO_4$ -; KOH: orange yellow; Lactophenol Cotton Blue: hyphal contents stain blue; lactic acid: -; I_{Melzer} -; NH_4OH: olive brown; phenol -; Sudan Black: granular contents of some hyphae stain black; Sudan IV -; sulfovanillin -; sulfuric acid -.

Nuclear staining: Nuclear staining with bisbenzimide revealed, that the fungus is monokaryotic at least in all the cells in culture (fig. 2).

Cultivated material: GERMANY, *Bayern*: Oberbayern, München, Kapuzinerhölzl N of the Botanic Garden, [48°10'N, 11°30'E], X 1989, *G. Rambold* 5793.

3.1.3. The distribution of Anthina flammea

Hitherto, reports of *A. flammea* exist only from Central and Northern Europe, where it grows in the litter layer of deciduous forests. Since there are few collections of this mostly overlooked species, it is not possible to get clear distribution patterns.

Specimens examined (analysis nos. in brackets):
SWEDEN: *Uppland*: Dannemora par., Andersby, På nedliggande vissna lõv, [60°13'N, 17°50'E], 3 X 1972, *K. & L. Holm* (UPS) [A-029]. – St. Olofs par., just N of Sigtuna, mixed forest E of the main road, on moist decaying leaves of *Betula pendula* and *Populus tremula*, [59°36'N, 17°44'E], 16 XI 1979, *S. Ryman* 5547 (UPS) [A-030]. GREAT BRITAIN: *Scotland*: Moray, Forres, [57°37'N, 3°38'W], 1873, *J. Keith* (K ex hb. J.M. Berkeley) [A-020]. – Angus, Glamis, [56°37'N, 3°01'W], 1879, *J. Stevenson* (K ex hb. J.M. Berkeley) [A-021]. – *England*: Hereford, Haywood Forest, Hereford, [52°04' N, 2°43'W], X 1885, *M.C. Cooke* (?), COOKE, Fungi Exs. Sel. [without number] (K) [A-023]. – Maecais, Hereford, 1872, [no collector], (K) [A-024]. – King's Cliff, no date, no collector (K ex hb. J.M. Berkeley) A-026. - [no locality, no date, no collector], BERKELEY, British Fungi no. 206 (K) [A-025]. FRANCE: "Forêt de Churu, sur feuilles de hêtre a terre", [no date], *Fautrey* (UPS) [A-031]. – (?) Fougères de la Blaie, [? 48°21'N, 1°12'W], [no date, no collector] (K ex hb. J.M. Berkeley) [A-022]. – GERMANY: *Sachsen*: Dresden, ad folia dejecta *Quercus*, [no date], [51°03'N, 3°45'E], *J.F. Klotzsch* (?), KLOTZSCH, hb. Mycologicum no. 134 (K) [A-028]. – *Brandenburg*: Kesselberg bei Tamsel, auf faulenden Blättern von *Quercus pedunculata* [= *Qu. robur*], 14 X 1914, *P. Vogel*, SYDOW, Mycotheca

Germanica no. 1399 (K, M) [A-019, A-005]. – *Berlin*, [52°32'N, 13°25'E], XI 1895, *P. Sydow*, SYDOW, Mycotheca Germanica (?) no. 4399 (K) [A-018]. – *Hessen*: 'Ad *Quercus* folia putrida, non frequens. Autumno. In sylva Hostrichiensi.', [no date, no collector], FUCKEL, Fungi Rhenani no. 1659 (M) [A-002]. – Bayern: Oberbayern, München, Kapuzinerhölzl N of the Botanic Garden, [48°10'N, 11°30'E], X 1989, *G. Rambold* 5793 (M) [A-032]. – Oberbayern, Buchenwald bei Stockdorf, MTB 7934, auf Buchenblattstreu, [48°06'N, 11°25'E], Herbst 1978, *A. Einhellinger* 400/80 (M) [A-001]. – POLAND: High Beskid, Babia Mount, W.07 Moky Stawek, on undersides of petioles of leaves of *Fagus sylvatica* and [?] *Acer pseudoplatanus*, [49°30'N, 19°30'E], 11 X 1972, *A. Bujakiewicz* (K) [A-017]. – AUSTRIA: Niederösterreich: Schweikwald bei Brunn (= ? Brunn am Gebirge), [48°42'N, 15°32'E], X 1862, *G. Nießl von Mayendorf* (M) [A-004]. – [No locality], 'Buchenblätter', X 1866, [no collector] (M) [A-006]. - [No locality], IX 1873, [no collector] (K ex hb. G. Winter) [A-027]. – (?) 'Folia conglobata penetrans Holpke Brock', X 1842, [no collector] (M) [A-003].

3.1.4. Discussion

Since the validification of the genus *Anthina* by FRIES (1832), no comprehensive characterisation of the type species *A. flammea* was given. Beside the latter species, FRIES (l. c.) included seven further species into the subgenus: *Anthina purpurea*, *A. fulva*, *A. flavovirens*, *A. umbrina*, *A. canofusca*, *A. filaris*, *A. dichotoma*, and three other species in *Anthina* subg. *Pterula*. Some taxa were later described as new by several authors, e.g. *A. cinnabarina* Berkeley & Broome or *A. pallida* De Bary.

Some authors have postulated teleomorph connections to the genus by suggesting well known species or genera. PETCH (1933) proclaims that *Anthina cinnabarina* is the immature form of *Cordyceps pruinosa* Petch [?= *C. militaris* (L. ex St. Amans) Link]. DONK (1962) assumed a relationship of *Anthina flammea* to the basidiomycete *Phanerochaete sanguinea* (Fr.) Pouz. [= *Peniophora sanguinea* (Fr.) Hoehn. & Litsch]. WATLING (1979) suspected *A. flammea* to be close to the *Dermocybe semisanguinea* complex.

A capability of *A. flammea* to form mycorrhizae in culture has not been tested, but the vigorous growth of the fungus together with the capability to produce extracellular oxidases as shown on tannic acid agar does not suggest such an ecological behavior. Nuclear staining reveals that *A. flammea* might be a monocaryotic state of a basidiomycete or an ascomycete. Therefore, we examined the following corticioid and clavarioid basidiomycetes with a yellow or red pigmentation by t.l.c.: *Clavulinopsis corniculata* (Fr.) Corner, *C. helvola* (Fr.) Corner, *C. laeticolor* (Berk. & Curt.) Petersen, *Macrotyphula fistulosa* (Fr.) Petersen, and *M. juncea* (Fr.) Berthier (Fam.

Clavariaceae), *Phlebia radiata* Fr. and *Phlebia rufa* (Fr.) Christ. (Fam. Corticiaceae), *Hymenochaete cruenta* (Pers.:Fr.) Donk (Fam. Hymenochaetaceae). None of these species shows an identical pattern of substances, and it is very likely, that the species listed above are not the teleomorphs of *Anthina flammea*.

Among the ascomycetes examined, however, the substances F1 and F2, which were found in *A. flammea*, were traceable also in several species of the genus *Cordyceps*, e.g. *C. capitata* (Holmsk.) Link, *C. militaris* (L.) Link, *C. ophioglossoides* (Ehrh. ex L.) Link (Fam. Clavicipitaceae) and also in some other genera of pyrenomycetous ascomycetes. These two substances, however, may be due to a basic wall component and therefore not be specific on a lower systematic level. On the other hand, the red pigment P1, which was found in some specimens of *A. flammea*, was not tracable in any of these genera.

In regard to the results, it still seems likely to the authors, that *A. flammea* might be the saprophytic anamorphic state of a *Cordyceps* species. We would agree with PETCH (1933), who stated that *Anthina cinnabarina* is the immature form of *Cordyceps pruinosa* Petch [? = *C. militaris*]. In the case of *A. flammea*, the teleomorph state may be the similarily colored *C. militaris*, which parasitizes the larvae and pupae of Lepidoptera (hidden in soil and detritus). The conidiogenous anamorph species of *Cephalosporium* and the species *Isaria farinosa* (Dicks.) Fr. show some similarities to the teleomorph of *C. militaris* (BREITENBACH & KRÄNZLIN 1981, PETCH 1938). Because of the habitual similarity to *Isaria farinosa*, it seems not unlikely, that *A. flammea* may be a non-conidiogenous, saprophytic, anamorphic stage of *C. militaris*.

For a final prove of a possible conspecifity of *Cordyceps* and *Anthina*, infection tests and more detailed chemical analyses are planned.

3.2. Further representatives of the genus Anthina

The herbarium material of several species, which may be closely related or identical with *A. flammea*, was examined. These taxa, like the latter species, also show only very few morphological and diagnostically relevant characters. On the basis of the mostly poorly developed herbarium specimens, which are available, and because of the absence of sufficient and vital material, it is impossible, to work out definite delimitations between the taxa. However, one can make some observations on the taxa under study.

Dried material of *Anthina aeruginosa*, *A. filaris*, *A. purpurea*, and *A. cinnabarina* was examined by the authors and showed that the material stored in different herbaria seems to be diverse: *Anthina aeruginosa* Fckl. seems to be similar to *A. flammea* or even identical with it, but most hyphae are heavily incrusted. Specimens determined by L. Fuckel to be *Anthina filaris* Fr., show a lighter, but more reddish pigmentation, and the hyphal walls are coarse. The type material of *Anthina cinnabarina* J.M. Berkeley & Broome is obviously conidiogenous. The material located in M under the name *Anthina purpurea* Fr. is heterogenous and some specimens are similar to *A. flammea*.

Specimens of the related taxa examined (analysis nos. in brackets):
Sub **Anthina aeruginosa**: GERMANY: *Hessen*: 'Ca. Hostrichiam. Ad mala putrida cum foliis tecta, raro.', [no date, no collector], FUCKEL, Fungi Rhenani no. 168 (K, M - isotypes) [A-011, A-014]. - Sub **Anthina cinnabarina**: SRI LANKA: 'Peradenia (Peradeniya) G.H.K.I.', XI 1867, [no collector], (K, ex hb. J.M. Berkeley, isotype) [A-012]. - Sub **Anthina dichotoma**: AUSTRIA: *Niederösterreich*: '? .....-wälder zwischen Neuwaldegg und Plötzleinsdorf', [no date], *G. Nießl von Mayendorf* (M) A-008. -- 'In den Neuwaldegger Wäldern', VIII, IX, *G. Nießl von Mayendorf* (M) [A-007]. -- (?), 'Schneibwald', X 1862, *G. Nießl von Mayendorf* (M) [A-009]. - Sub **Anthina filaris**: GERMANY: *Hessen*:'Ad *Quercus* folia putrida, raro. Autumno. In sylva Hostrichiensi.', [no date, no collector], FUCKEL, Fungi rhenani no. 1660 (K, M) [A-010, A-013]. - Sub **Anthina purpurea**: GERMANY: *Sachsen*: 'Dresden, ad folia decidua, *Quercus*, *L. Rabenhorst*, RABENHORST, Klotzschii hb. Vivum Mycol. (ed. II) no. 134 (M) [A-016]. - [No locality], 'ad folia putrida, auctumno', [no date, no collector], RABENHORST, Klotzschii hb. Vivum Mycol. (ed. I) no. 270 (M) [A-015].

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NEW SPECIES OF *OPEGRAPHA* FROM SOUTH-WESTERN EUROPE AND NORTHERN AFRICA

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ABSTRACTS: Three species of *Opegrapha* found in the western Mediterranean area are discussed and proposed as new: *O. confertoides* Torrente & Egea and *O. xerica* Torrente & Egea are corticolous; *O. lusitanica* Egea & Torrente occurs on calcareous rock.

In the recent taxonomic treatment of the family *Opegraphaceae* in the Mediterranean area of the Iberian Peninsula and northern Africa, provided by the authors (Torrente & Egea 1989), some problematic specimens were not treated by reason of their probable relation with some poorly understood centroeuropean species, such as: *Opegrapha phegospila* Nyl., *O. areniseda* Nyl. and *O. quadriseptata* Nyl. Type material of these species was later examined and found to differ from our specimens in several important respects. In the present contribution a formal description of three of them are provided.

Opegrapha confertoides Torrente & Egea spec. nova.
Figures 1-3

Thallus crustaceus, continuus, cremeoalbus vel griseoalbus, ecorticatus. Ascomata lirellata, 0,3-1,5 x 0,15-0,35 mm, sessilia, marginata, disco nigro. Excipulum integrum, carbonaceum, in parte laterali usque ad 50 µm latum, in parte inferiori usque ad 90 µm latum. Hymenium hyalinum, I+ rufescens. Subhymenium +/_ brunneum, I+ caeruleum. Paraphysoides ramosae et anastomosantes, usque ad 2 µm crassae. Asci clavati, fissitunicati, 45-70 x 12-15 µm. Ascosporae ellipsoideae vel fusiformes, triseptatae, 16-22 x (4)5-6 µm, rectae vel leviter curvatae, primum incoloratae deinde brunneae, septis incrassatis. Pycnidia immersa. Conidia rectae, 3-4 x 1 µm.

Type: Portugal, Estremadura, Sintra, Castillo de los

Moros, 250 m, sobre *Quercus* sp., 19.2.1987, *Egea* (MUB 13187-holotype; GZU-isotype).

Thallus crustose, continuous, creamy white to white, greyish or greenish, effuse, with smooth surface and occasionally with a thin, black, marginal prothallus. In section, ecorticate and without a distinct medulla. Photobiont *Trentepohlia*.

Ascomata numerous, sessile, scattered, lirelliform, 0,3-1,5 x 0,15-0,35 mm, simple with a prominent margin and slit-line disc, becoming slightly widened when old, epruinose. Excipulum well developed, carbonaceous, 25-50 µm laterally and 60-90 µm at the base, K+ green. Hymenium hyaline, 50-80(87) µm, I+ reddish. Subhymeniun pale to dark brown, 12-25 µm, I+ blue. Paraphysoids up to 2 µm wide, branched and anastomosing; apical cells slightly thickened, brown pigmented in the outer part of the wall. Asci claviform, fissitunicate, 45-70 x 12-15 µm at maturity; inner layer of the endoascus staining K/I+ blue, with a minute amyloid apical ring around the apex of a short ocular chamber (*Varia*-type, Torrente & Egea 1989). Ascospores 16-22 x (4)5-6 µm, triseptate, +/- ellipsoidal to fusiform, straight or slightly curved, without gelatinous sheath, hyaline but old spores becoming covered in brownish granular warts; cell wall thick and swollen at septa (*Rufescens*-type, Torrente & Egea 1989). Pycnidia immersed, punctiform. Conidia 3-4 x 1 µm, straight.

Chemistry: Thallus K-, C-, KC-, PD-; no lichen substances detected by TLC.

Distribution and habitat: This new species is known from some coastal localities of the Iberian Peninsula and Morocco. It grows on rough or smooth bark of trees or shrubs in humid and shaded places. In northwest Spain (Lopez de Silanes 1988) it is found with: *Arthonia fuliginosa* (Turner & Borrer) Flotow, *Dimerella pineti* (Ach.) Vezda, and *Graphis scripta* (L.) Ach.

Notes: In possessing ascospores of the *Rufescens*-type, *Opegrapha confertoides* appears to be closely related to *O. conferta* and *O. rufescens*. In the Table I the three species are compared. Using the descriptions and keys of various European authors (Redinger 1938, Poelt 1969, Clauzade & Roux 1985), this species could be confused with *O. phegospila* Nyl.. However, close examination of the type material of this taxon revealed the following characteristics: ascomata linear to gyrose and crowded, asci 65-75 x 16-18 µm, ascospores triseptate, 16-20 x 6-8 µm, with a thick gelatinous sheath, cell walls thin not or slightly thickened at septa (*Subelevata*-type, Torrente & Egea 1989) and conidia 6-8 x 1 µm. This combination of characters relates *O. phegospila* to *O. lutulenta* Nyl. and easily distinguishes both taxa from *O. confertoides*.

Additional specimens examined: MOROCCO, Playa de Abssanoubar, entre Bouznika y Mohammedia, 60 m, sobre *Pistacea lentiscus*, 16.4.1984, *Egea* (MUB).- SPAIN, Catalunya, Tarragona, Serra del Cadó, Barranque de Planelles, BF 9538, sobre *Hedera helix*, en una cova, 5.11.88, *Giralt* (BCC, MUB); Galicia, La Coruña, Caaveiro, Puentedeume, sobre *Alnus glutinosa*, 4.6.1986, *Lopez de Silanes* (hb. Lopez de Silanes, MUB).

Opegrapha lusitanica Egea & Torrente sp. nova. Figures 4-6

Thallus crustaceus, continuus aut +/- rimosus sed non areolatus, albus, ecorticatus. Ascomata lirellata, (0,3) 0,5-1,5 x 0,2-0,5 mm, sessilia, marginata, disco nigro, pruinoso. Excipulum integrum, in parte laterali usque ad 60 µm latum, in parte inferiori usque ad 160 µm latum. Hymenium hyalinum, I+ caeruleum. Subhymenium brunneum, I+ caeruleum. Paraphysoides ramosae et anastomosantes, usque ad 1,5 µm crassae. Asci cylindrici-clavati, fissitunicati, 48-65 x 12-16 µm. Ascospore oblongo-ellipsoideae, 15-20(22) x 4-5 µm, 4-5 septatae, halonatae, primum incoloratae deinde brunneae. Pycnidia immersa; conidia rectae, 4-7 x 1-1,2 µm.

Type: Portugal, Algarve, Sagrés, Cabo de San Vicente, 80 m, sobre rocas calcareas, 16.2.1987, *Egea* (MUB 13016-holotype; GZU-isotype).

Thallus crustose, white, continuous or cracked, with granulose surface, well developed, without a distinct prothallus. In section, up to 230 µm, ecorticate and with a cretaceous medulla; I+ blue beneath ascomata. Photobiont *Trentepohlia*.

Ascomata numerous, scattered, lirelliform, (0,3)0,5-1,5 x 0,2-0,5 mm, sessile, simple or seldom bifurcate, at first with narrow disc but soon widening, white-pruinose. Excipulum carbonaceous, well developed, 40-60 µm laterally and 140-160 µm at the base, K+ dark green. Hymenium hyaline, 60-70 µm tall, I+ blue. Subhymenium brown, 20-25 µm tall, I+ blue. Paraphysoids up to 1,5 µm wide, branched and anastomosing, with slightly incrassate apices. Asci cylindric-clavate, 48-65 x 12-16 µm at maturity; inner layer of the endoascus staining K/I+ blue, with a minute amyloid apical ring around the apex of a large ocular chamber (2-4 x 1-3 µm), where there is an incipient apical nase (between *Calcarea*-type and *Vulgata*-type, Torrente & Egea 1989). Ascospores oblong-ellipsoid, 15-20(22) x 4-5 µm, 4-5 septate, rarely with 3 or 6 septa, straight, surrounded by a thin gelatinous sheath, hyaline but old spores becoming covered in brownish granular warts; cell walls thin not swollen at the septa (like *Calcarea*-type, but more septate). Pycnidia immersed, punctiform. Conidia straight, 4-7 x 1-1,2 µm.

Chemistry: Thallus and medulla K-, C-, KC-, PD-; no lichen substances detected by TLC.

Distribution and habitat: Known only from a few localities in Portugal. It grows near the sea on limestone rocks which are shaded, on (sub)vertical cliffs and in small caves, exposed to NE-N-NW, where the substratum receives little or no direct rainfall. It is found with: *Arthonia meridionalis* Zahlbr., "*Opegrapha*" *durieui* Mont., *O. variaeformis* Anzi. Characteristic of the community of "*Opegrapha*" *durieui* (Egea 1989, sub. *Opegrapha* aff. *cesareensis*).

Notes: The closest related species to *Opegrapha lusitanica* are *O. cesareensis* Nyl. and *O. xerica* Torrente & Egea (described below). In Table II are summarized the main distinguishing characteristics between them. Similar spores are found too in the type material of *Opegrapha areniseda* wich differs in having an indiferentiate thallus, gyrose and crowded ascomata with a narrower, epruinose disc, and smaller spores (16-17 x 3-4 µm) and conidia (3,5-4,5 x 1 µm). This features related *O. areniseda* with *O. cesareensis*, both species described from Insula Caesarea (Nylander 1875, 1868).

Additional specimens examined: PORTUGAL: Algarve, Sagrés, Punta de Sagrés, c. 70 m, rocas calizas, 16.2.1987, *Egea* (MUB,TSB); Estremadura, Mafra, Ericeira, Carvoeiro, Playa de San Juliao, 15-25 m, rocas calizas, 20.2.1987, *Egea* (MUB).

Opegrapha xerica Torrente & Egea spec. nova Figures 7-9

Thallus crustaceus, tenuissimus, albus vel griseus, effusus, ecorticatus; medulla non evoluta. Ascomata lirellata, 0,5-1,5 x 0,15-0,35 mm, marginata, simplices; discus leviter expositus. Excipulum integrum, carbonaceum, in parte laterali usque ad 40 µm latum, in parte inferiori usque ad 85 µm latum. Hymenium hyalinum, I+ rufescens. Subhymenium brunnescente, I+ rufescens. Paraphysoides ramosae et anastomosantes, usque ad 1,5 µm crassae. Asci cylindrici-clavati; fissitunicati, 42-65 x 12-14 µm. Ascosporae oblongo-ellipsoideae, (12)14-20 x (3)4-5,5 µm, 3-5 septatae, hyalinae sed demun brunneo-verruculosae. Pycnidia immersa. Conidia recta, 4-6 x 1-1,2 µm.

Type: Morocco, Agadir, Cabo Rihr, 40-20 m, sobre *Euphorbia echinus*, 8.4.1987, *Egea* (MUB 13052-holotype; GZU-isotype).

Thallus crustose, whitish or greyish, thin, effuse, granulose to inconspicuous. In section without a distinct cortex or medulla.

Ascomata scattered, lirelliform, 0,5-1,2 x 0,15-0,35 mm, simple, at first with margin overtopping and hiding the hymenium except for a very thin slit-line, later the margin becomes somewhat split, exposing the sunken, +/- white pruinose disc. Excipulum well developed, carbonaceous, 35-

40 µm laterally, 70-85 µm at the base, K+ dark green. Hymenium hyaline, 50-75 µm tall, I+ reddish. Subhymenium pale brown, 15-30 µm tall, I+ reddish. Paraphysoids up to 1,5 µm wide, branched and anastomosing, with slightly incrassate apices. Asci cylindric-clavate, 42-65 x 12-14 µm at maturity; inner layer of the endoascus staining K/I+ blue, with a minute amyloid apical ring around the apex of a large ocular chamber (2-4 x 2,5 µm), where there is an incipient apical nase (between *Calcarea*-type and *Vulgata*-type, Torrente & Egea 1989). Ascospores (12)14-20 x (3)4-5,5 µm, 3-5 septate, oblong-ellipsoid, with upper cells broader and longer than the lower, surrounded or not by a thin gelatinous sheath, hyaline and smooth but sometimes becoming brown and warted; cell walls thin, not swollen at septa. Pycnidia immersed, punctiform. Conidia straight, 4-6 x 1-1,2 µm.

Chemistry: Thallus K-, C-, KC-, PD-; no lichen substances detected by TLC.

Distribution and habitat: *Opegrapha xerica* is at present known only from a few localities in Morocco and in Formentera (Balearic Islands). It occurs as an epiphyte of trees and woody or fleshy shrubs, in arid to dry areas of the Mediterranean region.

Notes: This new species was previously named as *Opegrapha* aff. *quadriseptata* Nyl. (Torrente 1987). Examination of the type specimen of *O. quadriseptata* Nyl. (H-NYL 6480-holotype) revealed that this species belongs to the genus *Arthonia*. In Table II, are summarized the main distinguishing characteristics between *O. xerica*, *O. lusitanica* and *O. cesareensis*.

Additional specimens examined: MOROCCO: Doukkala, plage de Sidi Rahal, sur vieux *Tamarix*, 1.1932, *Gatteffossé* (BC-Werner, sub *O. graphidiza* Nyl.); littoral près Dar Salem, sur écorce de *Tamarix*, 10.1931, *Gatteffossé* (BC-Werner, sub *O. betulina* Sm. and *O. rimalis* Pers.- SPAIN, Baleares, Formentera, epifito, 28.12.1967, *Llimona* (BCC, sub *O. niveoatra* (Borr.) Laundon)

Additional species verified:

Opegrapha areniseda Nyl., Flora 58: 446 (1875); type: (United Kingdom), Insula Caesarea, St. John's, 1873, *Larbalestier* (H-NYL 60179, holotype).

See notes under *Opegrapha lusitanica*.

Opegrapha cesareensis Nyl., Flora 51: 477 (1868); type: (United Kingdom), Noirmontiers, Jersey, 1868, *Larbalestier* (H-NYL 6013, holotype).

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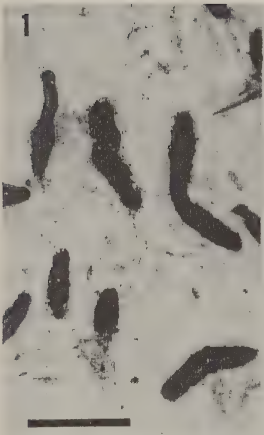

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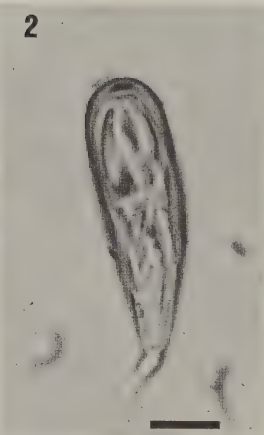

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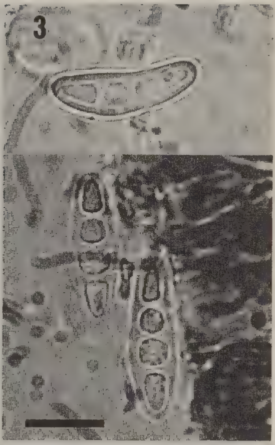

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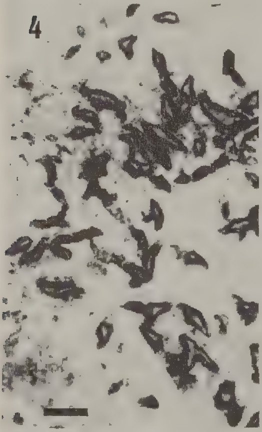

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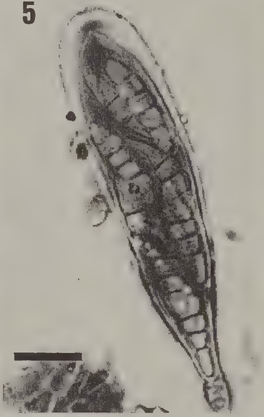

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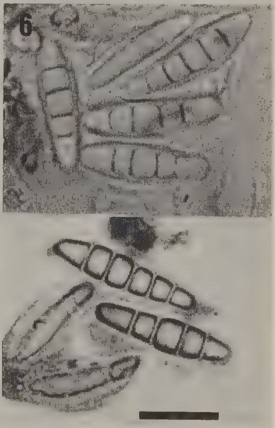

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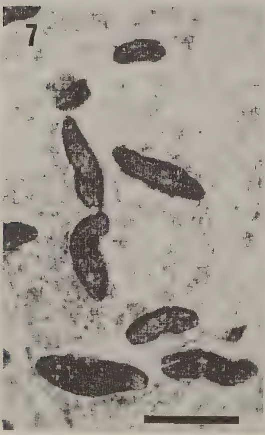

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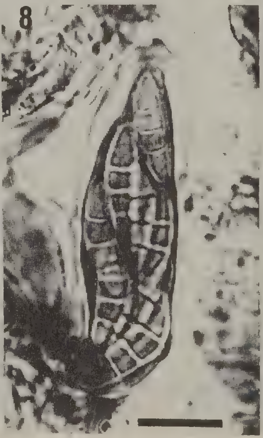

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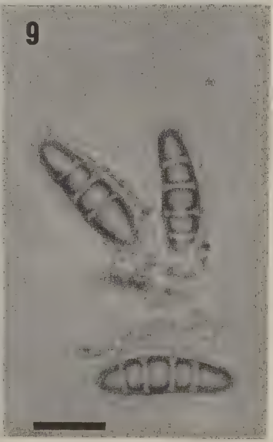

See Table II.

Opegrapha conferta Anzi, Comm. Soc. Critt. 1(3): 160 (1862); type: (Italy, Etruria), ad rupes graniticas valde umbrosas Monte Pisana, Ripa, presso Serravezza, *Anzi* (TO, isotype).

See Table I.

Opegrapha phegospila Nyl., Bull. Soc. Linn. Normandie, sér. 2, 6: 293 (1872); type: (France), Pyrennees Orient., Fount del Fajousse, 700 m, 7.8.1872, *W. Nylander* (H-NYL 6325).

See notes under *Opegrapha confertoides*.

Opegrapha quadriseptata Nyl., Lich. Envir. Paris 106 (1896); type: (Francia), super corticen aesculi ad Melodunum, 1855, *W. Nylander* (H-NYL 6480, holotype).

This taxon belongs to the genus *Arthonia*.

Opegrapha rufescens Pers., Ann. Bot. (Usteri) 1: 29 (1794); type: Herb. Persoon (L, lectotype)

See Table I.

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We wish to thank Dr. B. J. Coppins (Edinburg) for critical reading and correcting the manuscript, and Dr M. Giralt (Barcelona), Dr M. E. López de Silanes (La Coruña) and the curators of the following herbaria for the loan of material: BC, BCC, BM, H, L, TO. We thank the Dirección General de Investigación Científica y Técnica (DGICYT) for financial support through the project PB 87-0691.

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FIGURES 1-9 New species of *Opegrapha*: 1-3 *O. confertoides* (holotype, MUB); 1. Ascomata; 2. Young asci; 3. Ascospores.- 4-6 *O. lusitanica* (holotype, MUB); 4. Ascomata; 5. Asci; 6. Ascospores.- 7-9 *O. xerica* (holotype, MUB); 7. Ascomata; 8. Asci; 9. Ascospores. Scales: 1, 4, 7 = 1mm; 2, 3, 5, 6, 8, 9 = 10 µm (mounted in K/I).

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TABLE I: Comparison between *Opegrapha confertoides*, *O. conferta* and *O. rufescens*

	O. confertoides	*O. conferta*	*O. rufescens*
Thallus	smooth, and usually creamy white	granular inconspicuous and creamy	grayish to brownish with whitish patches
Ascomata (mm)	simple, sessile and scattered 0,3-1,5 x 0,15-0,35	often gyrose and crowded, sessile 0,6-1 x 0,2-0,3	simple immersed or semi-immersed 0,4-1(1,3) x 0,13-0,3
Hymenium (µm)	I+ reddish 50-80 (87)	I + blue 80-100	I + reddish 50-62,5
Asci (µm)	Varia-type 45-70 x 12-15	Vulgata-type 50-61 x 12-14	Vulgata-type 40-58 x 11-13
Ascospores (µm)	3-septate wall thick 16-21 x (4)5-6	3-septate wall thick 15-19 x 4-5	3-septate wall thick 15-23 x 3-4(5)
Conidia (µm)	3-4 x 1 straight	5-7 x 1-1.2 straight	4-7 x 1,2-2 straight to curved
Habitat	corticolous	saxicolous	corticolous

TABLE II: Comparison between *Opegrapha cesareensis*, *O. lusitanica* and *O. xerica*

	O. cesareensis	*O. lusitanica*	*O. xerica*
Thallus	granulose to inconspicuous, whitish	thick and well developed, white	granulose to inconspicuous, whitish or greyish
Ascomata (mm)	branched, often gyrose and crowded disc not exposed and epruinose 0,5-2 x 0,2-0,4	simples or rarely bifurcate, disc widely exposed, white-pruinose (0,3)0,5-1,5 x 0,2-0,5	simples; disc somewhat exposed when old, ± white pruinose 0,5-1,5 x 0,15-0,35
Hymenium (µm)	I+ blue, 67-87	I+ blue, 60-70	I+ reddish, 50-75
Asci (µm)	55-65 x 12-13	48-65 x 12-16	42-65 x 12-14
Ascospores	(13)16-25 x 3-4	15-20(22) x 4-5	(12)14-20 x (3)4-5,5
Septa	(3)4-6 (7)	(3)4-5 (6)	3-5
Habitat	acids rocks	calcareous rock	corticolous

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LECANACTIS STELLARIS, A NEW LICHEN FROM FRENCH GUIANA

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ABSTRACT: *Lecanactis stellaris* is described as new species and characterized by its stellate or substellate ascomata, asci of *Abietina*-type, and ascospores that are narrowed at one end.

Lecanactis stellaris Egea & Aptroot sp. nov. Figures 1-4

Thallus crustaceous, epiphloedus, albus, ecorticatus. Ascomata brunneus, adnata, lirellata, 0,7-1,8 x 0,3-0,4 mm, substellata aut stellata. Excipulum fusconigrum. Paraphysoides ramosae et anastomosantes, usque ad 1,5 µm crassae. Asci fissitunicati, octospori, 56-70 x 16-19 µm. Ascosporae fusiformes, in uno apice +/- rotundato, in altero apice atenuato, 23-30 x 4-5 µm, 3(4) septatae.

Type: French Guiana, Saül, 2 km SW of the village, "sentier limonade", 03º32'N 53º12'W, 180-210 m, lowland moist forest on lateritic soil, epiphytic on upper trunk of *Micropholis venulosa*, 12.9.1986, *D. Montfoort & R. C. Ek* (U-holotype; hb. Aptroot, CAY, MUB-isotypes).

Thallus corticolous, epiphloeodal, crustose, whitish, effuse, continuous to somewhat cracked, with smooth or slightly verruculose surface, tightly attached to the substratum, epruinose; prothallus not seen. In section, up to 250 µm high, composed of a plectenchyma without a distinct medulla or cortex, totally interspersed with granules and crystals, several of them of calcium oxalate, mostly found next to the ascomata (identified by its dissolution and recrystallization as calcium sulphate in H_2SO_4); granules and crystals insoluble in K or HNO_3.

Ascomata numerous and aggregated to form distinct amalgamated structures (synascomata), pluricarpocentral with multiascal locules (sensu Tehler 1990: 2465), lirelliform, 0,7-1,8 x 0,3-0,4 mm, irregularly substellate or stellate, adnate, without a constricted base, more or less dark brown, epruinose, with a thin margin scarcely raised above the level of the disc, smooth, persistent, slightly darker than the plane, widened disc, not surrounded by thalline tissue. Excipulum dark brown, K+ green, well developed, plechtenquimatous with some scattered hyphae in the outer part, and conglutinated with hyphal walls strongly gelatinized, not easily discerned in the inner part; the excipulum (hypothecium, sensu Tehler 1990 and Thor 1990), extending down to the substrate. Hymenium colourless, 50-65 µm, I+ reddish, K/I+ pale blue. Subhymenium up to 25 µm, pale brown. Paraphysoids richly branched and anastomosing, 1-1,5 µm wide, only a few thickened at the apices, with external, brown granular pigmentation, forming a dark brown pseudoepithecium, without granules or crystals under polarized light. Asci clavate, 56-70 x 16-19 µm, of *Abietina*-type (Torrente & Egea 1989). Ascospores fusiform, upper apex rounded, lower end tapering to a narrow apex, 3(4)-septate, 20-30 x 4-5 µm, hyaline at all stages, thin walled, slightly thickened at the septa and without gelatinous sheath. Pycnidia not found.

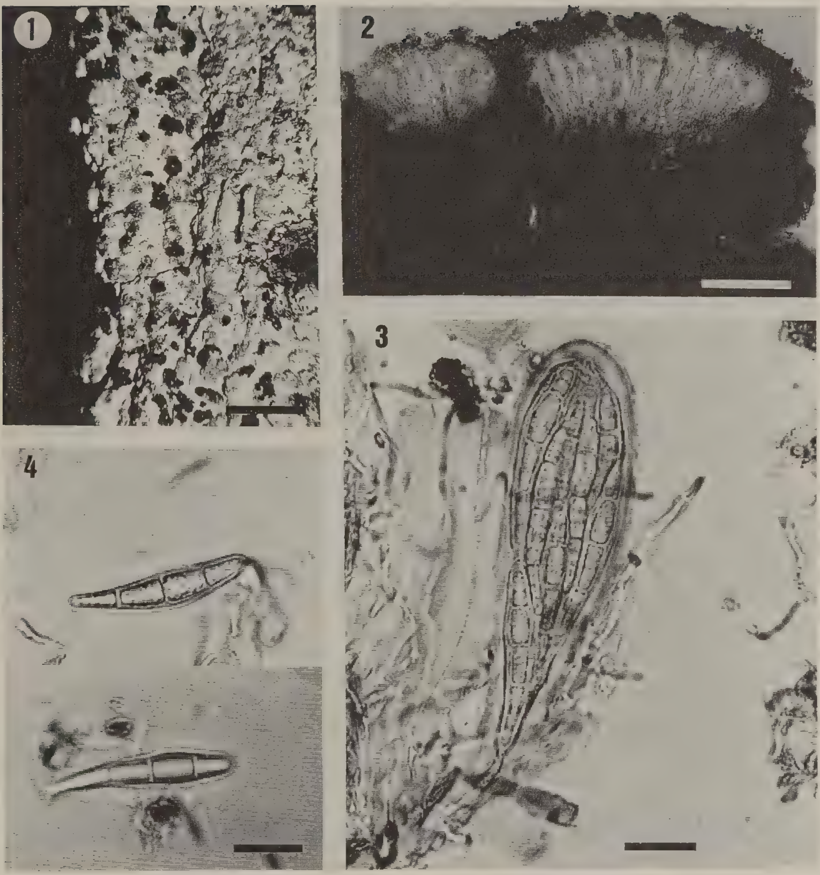
Chemistry: Thallus and medulla K- or K+ yellowish, C-, KC-, PD-; three unidentified substances detected by TLC (Table I).

TABLE I: TLC data in three solvent systems

Substance	A	B	C
Rf. class.	6,6,6-7	5,3,5	3,2,2
Spot colour after H_2SO_4 + heat	Orange-yellow	Pale rose-orange	Pale orange or colourless
U.V. Fluorescence - Before charring	Orange	--	--
- After charring	Orange-yellow	White yellowish	Vivid yellow

Distribution and habitat: Known only from the type locality.

Notes: This new species is referred to *Lecanactis* on account of the *Abietina*-type asci and the ascospores which are the same in some other *Lecanactis* species which are all



Figures 1-4 *Lecanactis stellaris*: 1. Thallus and ascomata; 2. Cross-section of ascomata; 3. Asci; 4. Ascospores. Scale: 1 = 5 mm; 2 = 50 mm; 3-4 = 10 µm (mounted in K/I).

closely related to *L. abietina* (Ach.) Körber. In possessing dark brown, stellate or substellate synascomata, epruinose disc and lack of crystals or granules in the pseudoepithecium, *L. stellaris* differs from all known species of *Lecanactis*. The form and size of its ascomata could suggest a *Opegrapha*. However, it differs in several important characters, such as: development and colour of ascomata and type of asci and ascospores.

ACKNOWLEDGEMENTS

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MYCOTAXON

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THE GENUS *BAUHINUS* GEN. NOV.: FOR SPECIES OF *USTILAGO* ON DICOT HOSTS

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SUMMARY

The new teleomorphic genus *Bauhinus* Moore is proposed for dicot-infecting species of smuts presently classified in the genus *Ustilago* (Pers.) Roussel. The key characters are 5S rRNA and siderochrome types, DNA homologies, response to the antibiotic Bacilysin, and how the sporidia are borne (sessile vs. pedicellate).

I. INTRODUCTION

Ustilago aside, the genera of smut fungi (Ustilaginaceae) are, with few exceptions (numbers belowin parentheses), restricted to either dicot or monocot hosts. A survey of the respective sets (Zundel, 1953) finds monocots infected by species of *Cintractia* Cornu, *Cintractiella* Boedijn, *Farysia* Racib., *Schizonella* Schröter, *Sorosporium* Rudolphi (1), *Sphacelotheca* de Bary (12), *Testicularia* Klotzsch, *Tolyposporella* Atk. (1), *Tolyposporium* Woronin ex Schröter (2), and *Tranzcheliella* Lavrov and dicots infected by species of *Glomosporium* Kochman, *Melanopsichium* Beck, *Mundkurella* Thirum., *Mycosyrinx* Beck, *Pericladium* Pass., *Thecaphora* Fingerh. (6), and *Ustacystis* Zundel. The genus *Ustilago*, however, has 251 spp., including the type, *U. hordei* (Pers.) Lagerheim, on five families of monocots (particularly, Poaceae) and 78 spp. on 19 families of dicots (Table 1).

Fundamental differences have been found between species infecting dicots and those infecting monocots (Table 2). Blanz & Gottschalk (1984) studying DNA homologies found much higher levels of recombination in DNA:DNA hybridization tests with intra-set than with inter-set species. They also examined the 5SrRNA of representative species and found that each set had its own general primary structure and that in the secondary structure the dicot species had uracil in the 107 position (Type A) but that this position was vacant (Type B) in the monocot species; they suggested that "... the smuts parasitizing dicots represent a group different from the graminicolous one. Having altered about one third of their 5SrRNA nucleotides, these smuts on dicots are, like the saprophytic *Rhodosporidium toruloides*, separated by a deep gap from all other *Basidiomycetes*." (The Basidiomycota, the basidiomycetes proper, also have the Type B molecule.) Kimmich (in Deml, 1987) found that the antibiotic Bacilysin inhibited *in vitro* growth of dicot-infecting, but not monocot-infecting species. Deml (1987) reported that the siderochrome of dicot-infecting species was rhodotorulic acid whereas that of the monocot-infecting species was of the ferrochrome type. These molecular biology traits are accompanied by an easily observed morphological character: sporidial ontogeny. Deml (1987) germinated ustospores *in vitro* and found that ustidia (Moore, 1988) of monocot-infecting species produced the sporidia on pedicels but that the sporidia of dicot-infecting species were borne sessile.

The deep dichotomy (Table 2) between the two species sets in the Ustilaginaceae is, I believe, sufficient to warrant establishing a new genus for dicot-infecting species of *Ustilago*. This is diagnosed below and those six species reported by Deml (1987) are transferred. The remaining 72 species of *Ustilago* that infect dicots (Zundel, 1953) are listed in Table 3; there are undoubtedly a number of additional species that have been described subsequently. Investigations are needed before confirming their designation to *Bauhinus*.

TABLE 1.
HOST FAMILIES OF *USTILAGO* SPP.
(from Zundel, 1953)

DICOTS
Caryophyllaceae
Commelinaceae
Compositae
Cruciferae
Dipsacaceae
Euphorbiaceae
Gentianaceae
Haloragidaceae
Labiatae
Lauraceae
Leguminosae
Lentibulariaceae
Myrtaceae
Onograceae
Oxalidaceae
Polygonaceae
Portulacaceae
Rosaceae
Turneraceae

MONOCOTS
Bromeliaceae
Cyperaceae
Juncaceae
Liliaceae
Poaceae

II. DIAGNOSIS AND NEW COMBINATIONS

BAUHINUS Moore gen. nov.

Ordo Ustilaginales, *Ustilago* similis sed Dicotyledonae parasitica. Morphologicus et physiologicus facies obliqua: sporidia ab ustidia sessila ennata; siderochromas est acidus rhodotorulicus; 5SrRNA est typus A cum uracil in 107 loco; bacilysin est praesens.

Species typica: *Uredo tragopogonis-pratensis* Persoon (as *tragopogi pratensis*), Tenta. Dispos. Method. Fung., 57. 1797.

Etym: In honor of Jean Bauhin (1541-1613) who was the real founder of the genus *Ustilago* in the 1651, posthumously published, complete edition of his **Historia Plantarum Universalis**, vol. 2, p.418 (see Zundel, 1953); +L.-*us*, belonging to.

Bauhinus anomalus (J. Kunze) Moore, comb. nov.
BASIONYM: *Ustilago anomala* J. Kunze. Fungi Sci. Exs. 23: hyponym 1877; Winter in Rabenhorst Krykpt. Fl. 1^1(1881): 100.
TYPE HOST & LOCALITY: *Polygonum dumetorum* L. (Polygonaceae), Germany.

Bauhinus scabiosae (Sowerby) Moore, comb. nov.
BASIONYM: *Farinaria scabiosa* Sowerby. Engl. fung. 3: tab. 396, f.2. 1803.
TYPE HOST & LOCALITY: *Scabiosa arvensis* L. (Dipsacaceae), Switzerland.

Bauhinus scorzonerae (Albertini et Schweinitz) Moore, comb. nov.
BASIONYM: *Uredo tragopogi* var. *scorzonerae* Albertini et Schweinitz. Consp. fung. Lusatiae 130. 1805.
TYPE HOST & LOCALITY: *Scorzonera humilis* L. (Compositae), Europe.

Bauhinus tragopogonis-pratensis (Persoon) Moore, comb. nov.
BASIONYM: *Uredo tragopogonis-pratensis* Persoon (as *tragopogi pratensis*). Tenta. Dispos. Method. Fung. 57. 1797.
TYPE HOST & LOCALITY: *Tragopogon pratensis* L. (Compositae), Europe.

Bauhinus utriculosus (Nees) Moore, comb. nov.
BASIONYM: *Caeoma utriculosa* Nees. Syst. Pilze Schw. 1: 14. 1817.
TYPE HOST & LOCALITY: *Polygonum* sp. (Polygonaceae), Europe.

Bauhinus vinosus (E.L.R. & C. Tulasne) Moore, comb. nov.
BASIONYM: *Uredo vinosa* E.L.R. & C. Tulasne. Ann. Sci. nat. Bot. s_r. 3, 7: 96. 1847.
TYPE HOST & LOCALITY: *Oxyria digyna* (L.) Hill (Polygonaceae), Scotland.

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TABLE 2.
CHARACTERS & SPECIES OF THE SMUT DICHOTOMY
(from Deml, 1987)

Character	**Dicot hosts**[1]	**Monocot hosts**[2]
Host family	Polygonaceae Dipsaceae Lamiaceae Asteraceae	Poaceae
Infection site	ovaries, anthers, heads	inflorescences
Pedicels	absent	present
5S rRNA	type A	type B
Bacilysin	(+)	(-)
Siderochrome	rhodotorulic acid	ferichrome-type

Parasitic spp.: [1]*Microbotryum major, M. lychnidis-dioicae, M.silenes-inflatae, M. stellariae, M.violaceum, Sphacelotheca polygoni-persicariae, S.inflorescentiae (=Ustilago inflorescentiae), U.anomala, U.scabiosae, U.scorzonerae, U.tragopogonis-pratensis, U.vinosa, U.utriculosa (=U. cordae, =U.reticulata).* Species listed as synonyms are those names reported by Deml (1987).

[2]*Cintractia montagnei, Farysia thuemenii, Schizonella melanograma, U.avenae, U.bullata, U. cynodontis, U.hordei* (T), *U.hypodytes, U. longissima, U.maydis, U.perennans, U.spermophora, U. sphaerogena, U. syntherismae, U.trichophora.*

TABLE 3.
SPECIES OF *USTILAGO* PARASITIC ON DICOTS
(from Zundel, 1953)

acaenae
acetosellae
ahmadiana
albida
alsineae
anhweiana
arabis-alpinae
betonica
bistortarum
bungeana
calandriniae
calandriniicola
cardamines
cardui
caulicola
cenchri
cichorii
claytoniae
clintoniana
commelinae
domestica
dubiosa
duriaena
entorrhiza
euphorbiae
foliorum]
gayophyti
gigantispora
goeppertiana
gunnerae
holostei
inouyei
intermedia
jehudana
koemigiae
kuehneana
lagerheimii
lycoperdiformis
major
marginales
morinae
nannfeldtii
newaschini
ocrearum
onumae
oxalidis
parlatorei
picacea
pinguiculae
piperii
polygoni-alpini
punctata
pustulata
raciborskiana
rosulata
rumicis
salviae
scleranthi
scolymi
seminum
senecionis
shastense
stewartii
stygia
succisiae
tenuispora
thlaspeos
tuberculiformis
urbaniana
violaceae
vriesiana
warmingii

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DACTYLARIA LEPTOSPHAERIICOLA SPEC.NOV.

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Dactylaria leptosphaeriicola spec. nov.

Colonies effuse, dull greyish, on old pseudothecia of the host fungus, mycelium superficial, hyphae subhyaline, yellowish, pale olivaceous to brownish, creeping, septate, sparsely branched, smooth, 1-3 μm wide. Conidiophores solitary, sometimes in small, loose groups, arising from superficial hyphae, swollen cells or groups of such cells, lateral or terminal, about 10-40 x 2.5-4 μm, simple, pale olivaceous to brown, septate, smooth, the apical portion bearing minute, subcylindric denticles, ca. 0.75-1.25 μm long and 0.5-1 μm wide, apex truncate, unthickened. Conidia solitary, narrowly obclavate to fusiform, ca. 40-55 x 1.5-2.5 μm, (0-) 1 (-3)-septate, septa fairly inconspicuous, subhyaline to very pale olivaceous, smooth, apex subacute, base truncate, unthickened. Fig. 1.

Coloniae effusae, cinerascentes, in pseudothecia hospitis fungalis nidulantes. Mycelium superficiale: hyphae subhyalinae, flavidae, pallide olivaceae vel brunneae, repentes, septatae, leniter ramosae, laeves, 1-3 μm latae. Conidiophora solitaria, interdum laxe fasciculata, ex hyphis mycelialibus lateraliter et terminaliter oriunda, ca. 10-40 x 2.5-4 μm, simplicia, pallide olivacea vel brunnea, septata, laevia, denticulis 0.75-1.25 μm longis et 0.5-1 μm latis ornata. Conidia solitaria, anguste obclavata, fusiformia, ca. 40-55 x 1.5-2.5 μm, (0-) 1 (-3) septata, subhyalina vel

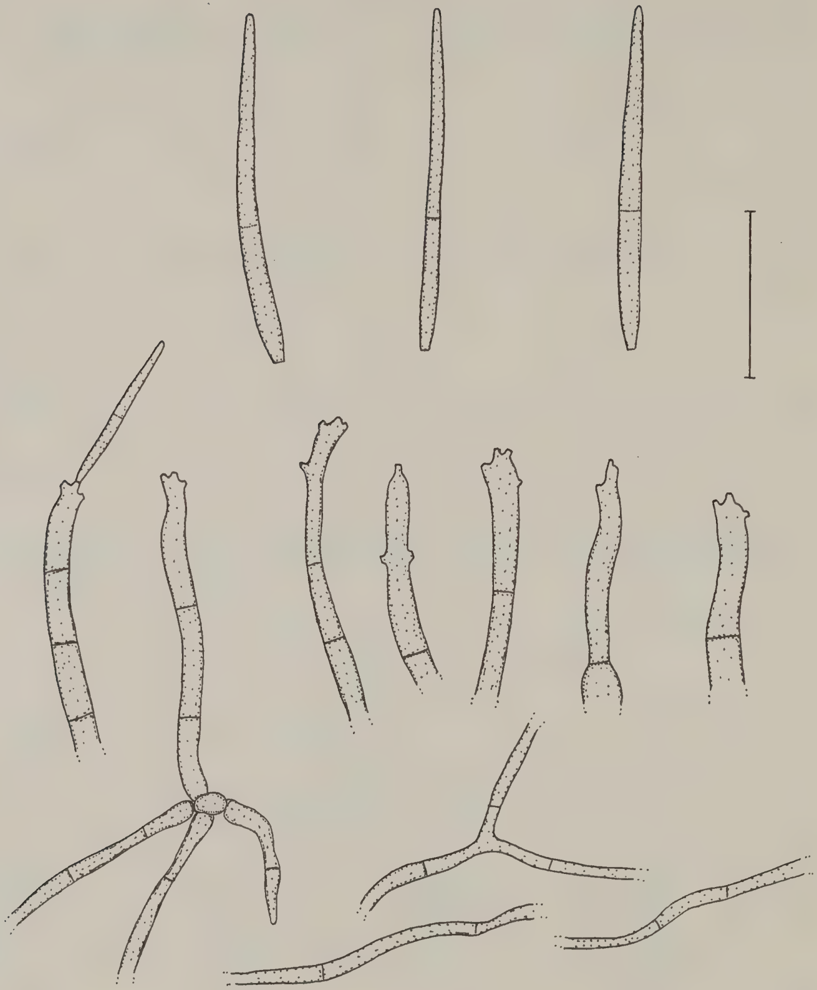

Fig. 1: *Dactylaria leptosphaeriicola* spec. nov., conidia, conidiophores, hyphae. Scale 25 µm. U. Braun del.

dilutissime olivacea, laevia, apice subacuta, basi truncata, non incrassata.

Holotypus: on pseudothecia of *Leptosphaeria protearum* (on *Protea repens*), South Africa, W. Cape, Helderberg, Sept. 1991, P. Crous (HAL).

In 1991, lesions of *Leptosphaeria protearum* on *Protea* leaves were cultured. After about 3-4 weeks this anamorph appeared on the old pseudothecia in moist chambers. The biology of this species is not quite clear. It is either hyperparasitic on *Leptosphaeria* or saprophytic. *D. leptosphaeriicola* is close to the saprophytic *Dactylaria fusiformis* Shearer & Crane (de Hoog 1985) and the hyperparasitic *D. pusilla* (Deighton & Piroz.) de Hoog & v. Arx (1974; = *Scolecobasidium pusillum* Deighton & Pirozynski 1972). The latter species is not included in the check-list of *Dactylaria* epithets (de Hoog & van Oorschot 1985). The new species belongs to *Dactylaria* sect. *Mirandina* (Arn. ex Mats.) de Hoog (1985). It differs from all related taxa by almost exclusively 1-septate conidia.

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THREE NEW PHYTOPARASITIC FUNGI FROM INDIA

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Summary: *Phloeosporella muntingiae* spec. nov., *Pseudocercospora cissi* spec. nov. and *Stigmella tirumalensis* spec. nov. are described.

(1) *Phloeosporella muntingiae* spec. nov.

Maculae amphigenae, suborbiculares vel leniter angulares, ca. 1-3 µm latae, denique centro griseo, margine angusti atrobrunneo cinctae et zona purpurascenti vel ochracei, pallide brunnei late cinctae. Mycelium immersum. Conidiomata (acervuli) hypophylla, albida, punctata, immersa, rotundata, ca. 50-150 µm diam., subepidermalia, ex cellulis hyalinis, ca. 2-8 µm latis, composita. Conidiophora subcylindrica vel leniter geniculata-sinuosa, laevia, hyalina, continua vel 1-2 septata, ca. 10-40 x 3-6 µm, ex cellulis basalibus oriunda. Cicatrices conidiales truncatae, non incrassatae. Conidia solitaria, obclavata, subcylindrica-acicularia, 30-60(-80) x 3-4.5 µm, hyalina, laevia, saepe 2-7 septata, non constricta, apice rotundata vel subacuta, basi truncata, non incrassata.

Holotypus: on *Muntingia* spec. (Elaeocarpaceae), India, Sri Tirumala Hills, Tirupathi (A.P.), II. 1989, Bagyanarayana (IMI 332957). Isotypus: HAL.

Leaf spots amphigenous, subcircular to slightly angular, ca. 1-3 mm diam., centre greyish-white, with narrow, dark margin, epiphyllously with purplish halo, hypophyllously with ochraceous to pale brown halo, mycelium internal, colourless, conidiomata (acervuli) hypophyllous, whitish, punctiform, subepidermal, circular, ca. 50-150 µm diam., basal layer composed of rounded to angular cells, ca. 2-8 µm diam., hyaline, conidiophores arising from the basal layer, ca. 10-40 x 3-6 µm, subcylindric, straight to curved, slightly geniculate-sinuous, smooth, continuous or with 1-2 septa, hyaline, with 1-2 broad, flat, unthickened conidial scars. Conidia solitary, obclavate, subcylindric-acicular, 30-60 (-80) x 3-4.5 µm, hyaline, smooth, mostly 2-7-septate, not constricted, apex rounded to subacute, base truncate, unthickened. Fig. 1.

There is no comparable species on *Muntingia* and related taxa.

(2) *Pseudocercospora cissi* spec. nov.

Maculae primo nullae, deinde sordide viridae, atrobrunneae, griseo-brunneae, griseo-albidae, 1-2 mm diam., saepe confluentes, angulosae, saepe per venas limitatae. Caespituli amphigeni. Mycelium primarium immersum. Stromata substomatalia vel intraepidermalia, ca. 10-45 µm diam., ex hyphis olivaceo-brunneis intertextis composita, ca. 2-8 µm diam. Mycelium secundarium superficiale, hyphae septatae, ramosae, 1.5-5 µm latae, laeves, pallide olivaceae. Conidiophora fasciculata vel solitaria, per stoma emergentia vel ex cellulis mycelii secundarii oriunda, 5-40 x 3-6 µm, simplicia, erecta, subcylindrica, geniculata-sinuosa, laevia, olivaceo-brunnea, 0-2 septata. Cicatrices conidiales inconspicuae. Conidia solitaria, obclavata (- subcylindrica, acicularia), 15-120 (-150) x 3-6 µm, 1-8 septata, interdum leniter constricta, laevia, pallide olivacea, apice rotundata vel subacuta, basi truncata.

Holotypus: on *Cissus* spec. (Vitaceae), India, Hyderabad, Shamirpet, XII. 1990, Bagyanarayana and Jagadeeswar (HAL).

Leaf spots at first almost absent, later dull greyish to dark brown, greyish brown, greyish white, angular, vein-limited, ca. 1-2 mm diam., but often confluent, caespituli amphigenous, primary mycelium internal, forming well developed or small stromata, substomatal or intraepidermal, ca. 10-45 µm diam., composed of swollen hyphae, ca. 2-8 µm diam., olivaceous-brown, somewhat erumpent, secondary hyphae arising from hyphal knots, superficial, creeping, septate, branched, 1.5-5 µm wide, smooth, pale olivaceous, conidiophores fasciculate, arising from stromata, fascicles loose to dense, or solitary, arising from superficial hyphae, 5-40 x 3-6 µm, simple, straight, subcylindric to geniculate-sinuous, narrowed towards the tip, smooth, olivaceous to brown, continuous or 1-2-septate, conidial scars inconspicuous. Conidia solitary, obclavate (- subcylindric, acicular), 15-120 (-150) x 3-6 µm, 1-8-septate, occasionally somewhat constricted at the septa, smooth, pale olivaceous, apex rounded to subacute, base truncate. Fig. 2.

Pseudocercospora cissi spec. nov. differs from *P. riachuelii* (Speg.) Deighton (1976, p.129) by superficial hyphae with solitary conidiophores.

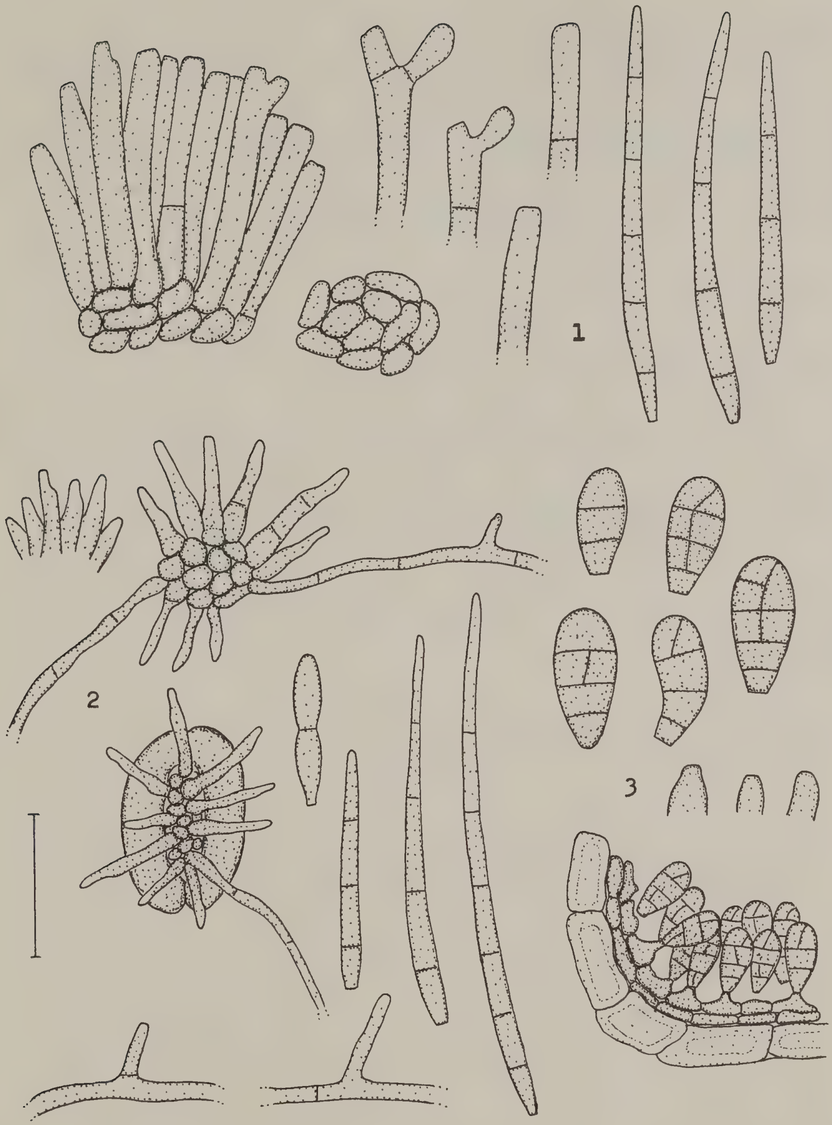

Fig. 1-3. *Phloeosporella muntingiae* (1), section through acervulus, stroma, conidiophores, conidia; *Pseudocercospora cissi* (2), fascicles of conidiophores, conidia, superficial hyphae; *Stigmella tirumalensis* (3), conidia, conidiogenous cells, section through pycnidium. Scale 25 μm. U. Braun del.

(3) *Stigmella tirumalensis* spec. nov.

Maculae amphigenae, angulosae, saepe per venas limitatae, ca. 1-4 mm diam., atro-brunneae, margine tenui, leniter elevato cinctae. Pycnidia amphigena, immersa, ca. 40-100 µm diam. (vel elongata, -200 µm longa). Peridia ex cellulis pallide brunneis composita, ca. 3-5 µm diam. Cellulae conidiogenae parvae, doliiformes vel ampulliformes, subhyalina, ex cellulis basalibus peridiorum oriundae. Conidia solitaria, muriformia, brunnea, ca. 10-14 (-21) x 6-9 µm, laevia, transverse septata (1-4) et oblique septata (0-3), apice rotundata, basi truncata.

Holotypus: on *Elaeodendron glaucum* (Celastraceae), India, Sri Tirumala Hills, Tirupathi (A.P.), II. 1989, Bagyanarayana (IMI 332960).

Leaf spots amphigenous, angular, often vein-limited, ca. 1-4 mm diam., dark brown, surrounded by a somewhat raised marginal line, mycelium internal, pycnidia amphigenous, immersed, subepidermal, ca. 40-100 µm diam. (sometimes elongated, up to 200 µm long), wall composed of rounded to angular cells, pale brown, ca. 3-5 µm diam., conidiogenous cells small, doliiform to ampulliform, subhyaline, formed from the inner cells of the pycnidial wall. Conidia formed singly, muriform, brown, ca. 10-14 (-21) x 6-9 µm, with 1-4 transverse septa and 0-3 longitudinal septa, apex rounded, base truncate. Fig. 3.

Comparable *Stigmella* species on *Elaeodendron* and allied host genera are unknown.

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REVISION OF THE TYPE OF ENDOGONE ALBA (ENDOGONACEAE)

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ABSTRACT

The type material of *Endogone alba* was examined and compared with the type of *Sclerocystis coremioides*. The structure of the sporocarp and arrangement of the sporulation elements are distinct from each other in these species. The sporocarp of *E. alba* contains numerous subspherical 'zygosporangia' distributed irregularly and lacks a sterile base whereas that of *S. coremioides* has a layer of numerous elongate 'chamydospores' radiating from a central hyphal network, and a sterile base. *Endogone alba* is redescribed on the basis of light microscope and electron microscope observations. It is concluded that *E. alba* is more closely related to *Endogone* than to *Sclerocystis* and is retained provisionally in *Endogone*.

Key words: *Sclerocystis alba*, SEM, TEM, taxonomy

Endogone alba (Petch) Gerdem. & Trappe (Gerdemann & Trappe, 1974) based upon material collected at Hakgala Botanic Garden, Sri Lanka was originally described as *Sclerocystis alba* Petch (Petch, 1925). The transfer to *Endogone* (Gerdemann &

Trappe, 1974) was based on the spores lacking hyphal attachments and the contents comprising oil-globules of nearly uniform size, presumed to be evidence of their zygosporic nature. Recently, *E. alba* was reduced to synonymy with *Sclerocystis coremioides* Berk. & Broome (Almeida & Schenck, 1990) as it was considered that the small, massed fused sporocarps and tropical habitat (Trappe & Gerdemann, 1974) are more characteristic of *S. coremioides*.

Petch (1925) described *S. alba* as having 'stromata' with scattered 'asci'. Although Gerdemann & Trappe (1974) did not give a full account of this species when they transferred it to *Endogone* they mentioned, however, that the spores were distributed at random within the gleba. As the arrangement of sporocarpic spores in *S. coremioides* has been described as regular and that of *E. alba* as irregular, type material of *E. alba* has been re-examined and compared with that of *S. coremioides* in order to define the mophological characters of *E. alba*.

MATERIALS AND METHODS

Type material of *E. alba* and *S. coremioides* is deposited in the Herbarium, Royal Botanic Gardens, Kew (K). The type collection of *E. alba* was examined by light microscopy (LM), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). For light microscopy, sporocarps were dissected with needles under the dissecting microscope or cut at 5 - 60 μm in thickness using a Reichert sledge-microtome with a Pelcool freezing stage after soaking in water for 30 min and mounted in distilled water, 5% KOH or PVLG (Omar *et al.*, 1979), or stained either with Melzer's Reagent or cotton blue. Sections, 0.5 μm in thickness, processed in the same way as TEM preparations were stained with 1% toluidine blue in 1% borax solution. Photomicrographs of whole sporocarps were taken using reflected light and of slides by transmitted light.

For SEM, untreated herbarium specimens were placed on double-sided sellotape on 1 cm aluminium stubs. Sporocarps manipulated on stubs with fine forceps were either sectioned *in situ* with a razor blade or dissected with needles to separate glebal elements. Mounted specimens were covered with platinum in an Emscope SC 500 sputter coater, examined at 18 kv and photographed in a Cambridge Stereoscan 240.

For TEM, exsiccate specimens were rehydrated in distilled water for 2 days, fixed in 2.5% glutaraldehyde in 0.1 M sodium cacodylate buffer solution, pH 7.2, for 24 h, washed in buffer for 20 min (3 times), post-fixed in aqueous 1% osmium tetroxide solution for 4 h, washed in distilled water for 20 min (twice), dehydrated through the ethanol series 30%, 50%, 70%, 90%, 100% at 1 h intervals, with two further changes in 100% ethanol then transferred to propylene oxide for 30 min (two changes). Specimens were embedded in Spurr's resin, sectioned either with a Reichert FC2 or Reichert - Jung ultratome, stained in saturated uranyl acetate solution followed by lead citrate, examined and photographed in a Jeol Jem - 100 cx II at 80kv.

RESULTS

Light microscopy

The sporulation apparatus of *E. alba* comprises lumpy, adherent aggregates of several sporocarps (Fig. 1). Debris of humus, sand and soil adhere to the surface of the aggregate. No foriegn matter has been observed in the gleba of the sporocarp although bacteria have been observed in the lumina of ultrathin sections of the glebal hyphae and in the cytoplasm of the 'spore'. For ease of reference, the sporulation element is regarded as a zygosporangium containing a single zygospore although the sexual origin of these 'spores' is not proven. The sporocarps in each aggregate are at a similar stage in development, each sporocarp, however, having its own individual structure. The sporocarps remain attached through mutual adhesion forming a compound structure; the applanate contact surfaces lacking the peridium.

A hyphomycete with dark-coloured conidia attached to some contact surfaces of sporocarps (Fig. 2), contrasted with the pale colour of the sporocarp. It is not known whether the hyphomycete is parasitic on the sporocarps.

In serial sections of sporocarps the peridium is a thin, ill-defined layer of narrow hyphae (Fig. 3). Glebal hyphae are 3 - 35 μm diam. and wall thickness varies from very thin to approximately 5 μm. Thick-walled hyphae are densely compacted in a zone adjacent to the peridium while both thick and thin-walled hyphae are intermixed in the inner part of the gleba where interhyphal spaces are also evident (Fig. 3). Some hyphae are distinctive in possessing a terminal inflation showing some degree of curvature (Fig. 4). The inflated termination may be paired, remininscent of the gametangia found in *Endogone flammicorona* Trappe & Gerdem. (Bucholtz, 1912, named as *E. lactiflua* Berk. & Broome). Some glebal hyphae with irregular swellings and occasional secondary septa were observed. The multispored sporocarp frequently contains more than 100 zygosporangia which are irregularly scattered thoughout the gleba from close to the sporocarp surface to the centre. The gleba lacks a sterile zone.

The zygosporangial surface bears broad, branching ridges, which appearing denticulate in freezing-microtome sections (Fig. 5) and as irregular protrusions in sections stained in toluidine blue (Figs 6 - 8). A fine rugulose inter-ridge surface ornamentation is also apparent at the highest magnification. The wall of the zygosporangium and that of zygospore usually adhere tightly although they can be separated by applying pressure on the zygosporangium under the cover slip (Fig. 9). The zygospore wall (3.5 - 6 μm) is thicker than the zygosporangial wall (0.5 - 2 μm) and both are continuous, lacking openings. Intact attachments of the zygosporangia have not been observed in dissected preparations,

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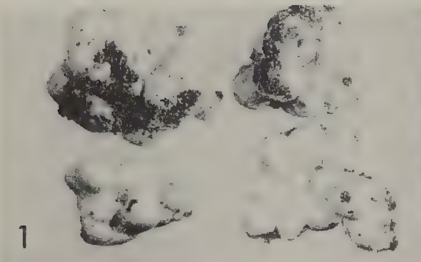
Figs 1 - 10. Light microsopy of *Endogone alba*. All magnifications are 350 times unless otherwise indicated. Fig. 1. Aggregations of sporocarps associated with debris. x 6. Fig. 2. A part of an aggregation of sporocarps after separation with needles showing colonies of a hyphomycete on the contact surfaces. x 25. Fig. 3. A section of a sporocarp stained in toluidine blue showing 'zygosporangia' scattered within the gleba. x 55. Fig. 4. A terminal inflation of a curved glebal hypha. Fig. 5. A 'zygosporangium', the wall appearing irregularly dentate (freezing-microtome section). Fig. 6. A section of a 'zygosporangium' with an intact attachment element, stained in toluidine blue. Fig. 7. A toluidine blue-stained section of the gleba with a 'zygosporangium' containing densely packed lipid globules. Fig. 8. A section of a 'zygosporangium' with a stalk but lacking the attachment element stained in toluidine blue. Fig. 9. A part of a broken 'zygosporangium' with a released zygospore which contains a large air bubble. Fig. 10. An intact 'zygosporangium' with an attachment scar.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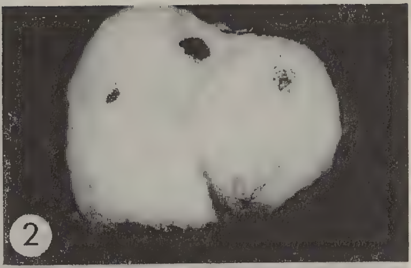
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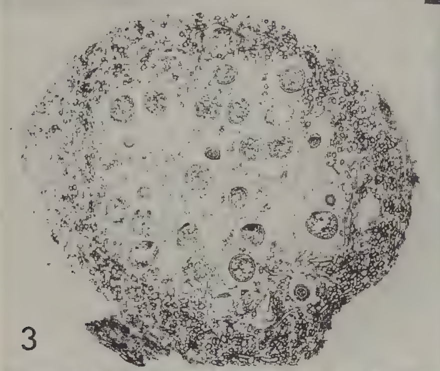
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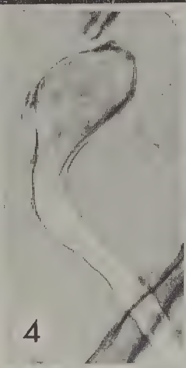
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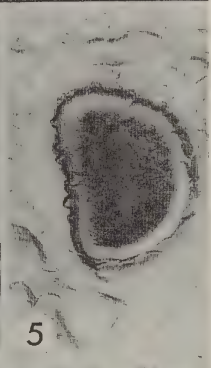
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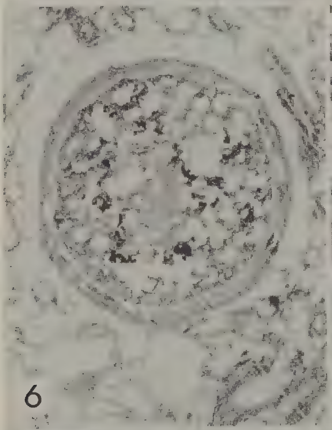
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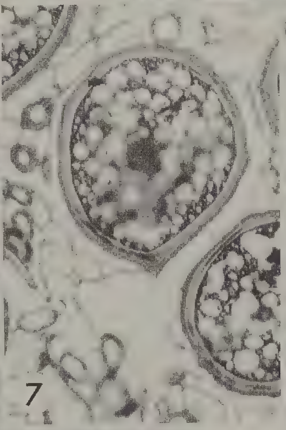
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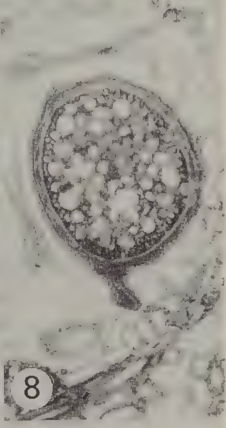
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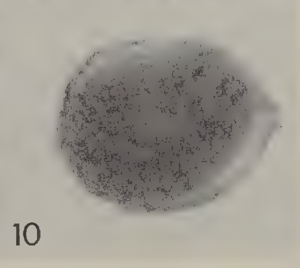
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only the break at the junction between the zygosporangium and its attachment being obvious (Figs 9, 10). A single, intact or broken, attachment of the zygosporangium was often seen in toluidine blue-stained sections (Figs 6 - 8). The attachment wall is continuous with the zygosporangial wall but much thinner. The junction of attachment is closed by both the zygosporangial and zygospore walls. Zygosporangia are either sessile or shortly pedicellate (Figs 6 - 8).

In Melzer's Reagent, individual glebal hyphae stain orange-red and cock's comb red in the mass in freezing-microtome sections. Zygosporangial and zygospore walls are either not stained or deepen only slightly in colour. In 5% potassium hydroxide, sections of gleba become transparent, the zygosporangial and zygospore walls separate and the spore contents may disintegrate. In toluidine blue, the zygosporangial wall, attachment wall and glebal hyphal walls in thin sections stain deep blue whilst the zygospore wall stains purple.

Scanning electron microscopy

The poorly developed peridial hyphae are narrower than those of the more variable glebal hyphae (Fig. 11). Glebal hyphae lining the cavity which remains after removal of the zygosporangium appear to form a compact layer (Fig. 12). These encapsulating hyphae usually appear loosely aggregated after rehydration, however, in sections for light microscopy (Figs 3, 6 - 8).

Zygosporangial ridges are also seen in the dried material (Fig. 13). The minute rugulose zygosporangial wall ornamentation is confirmed by SEM (Figs 13 - 15). Single scar of attachment of the zygosporangium is also evident in Figs 14 and 15. Zygospore

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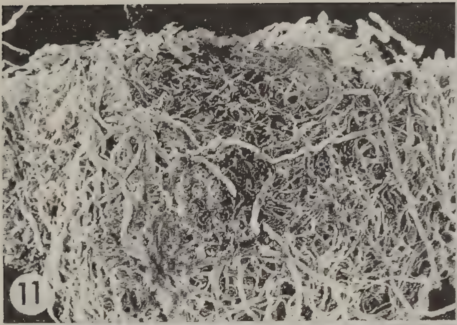
Figs 11 - 15. Scanning electron microscopy of *Endogone alba*. Fig. 11. A part of the sporocarp surface with woven peridial hyphae. x 120. Fig. 12. The interior of the hyphal investment which formerly surrounded a 'zygosporangium'. x 420. Fig. 13. A part of the gleba showing the 'zygosporangial' apparatus. x 310. Fig. 14. A 'zygosporangium' showing the minute surface ornamentation and attachment scar. x 1000. Fig. 15. An enlargement of part of Fig. 13 showing the attachment scar. x 5000.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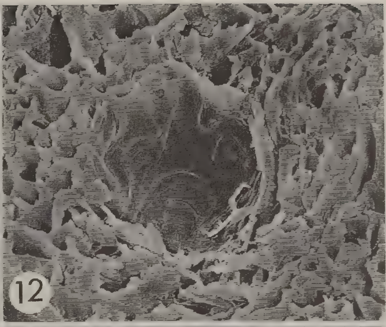
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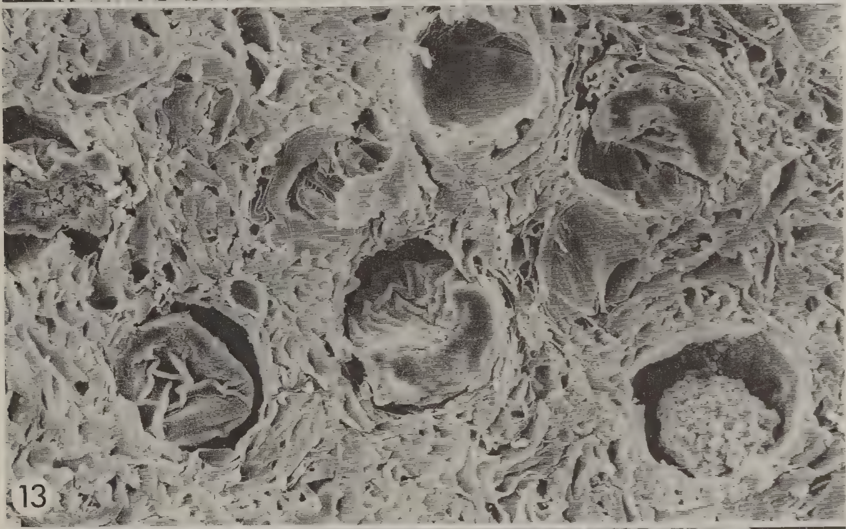
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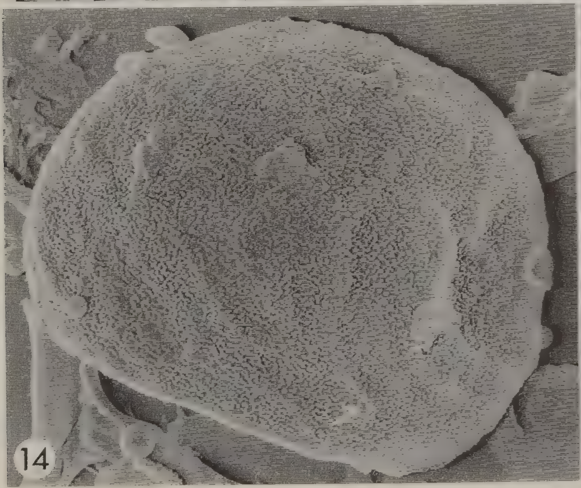
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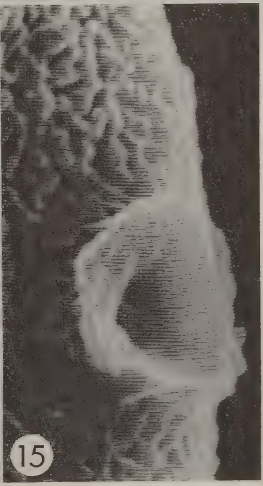
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contents as seen under the light microscope (Figs 3, 5, 6 - 8) appear sub-globose to globose and variable in size under SEM (Fig. 13).

Transmission electron microscopy

Figure 16 shows the variable wall thickness of the glebal hyphae and Fig. 17 one of the occasional secondary septa. An amorphous electron grey discontinuous layer of variable thickness, covers the verruculose, electron dense zygosporangial wall, which correlates with the minute rugulose ornamentation seen under both the LM and SEM (Figs 16, 18). The zygospore wall is electron grey and considerably thicker than zygosporangial wall. Cytoplasm of the zygospore contains membrane bound entities (Fig. 18) which probably correspond to the numerous globules found in the cytoplasm of preperations seen under the LM (Figs 3, 6 - 8) and in the SEM (Fig. 13).

Revised description of *E. alba*

The following revised description of the type material is provided by combining light microscope and electron microscope observations.

Endogone alba (Petch) Gerdem. & Trappe, Mycologia Memoir **5**: 25 (1974). Figs 1 - 19.
=*Sclerocystis alba* Petch, Ann. Roy. Bot. Gard., Peradeniya **9**: 32 (1925).

Sporocarps epigeous, amongst dead leaves, subglobose, ovoid or obovoid to irregular; (0.65) - 0.80 - 1.35 x (0.60) - 0.75 -

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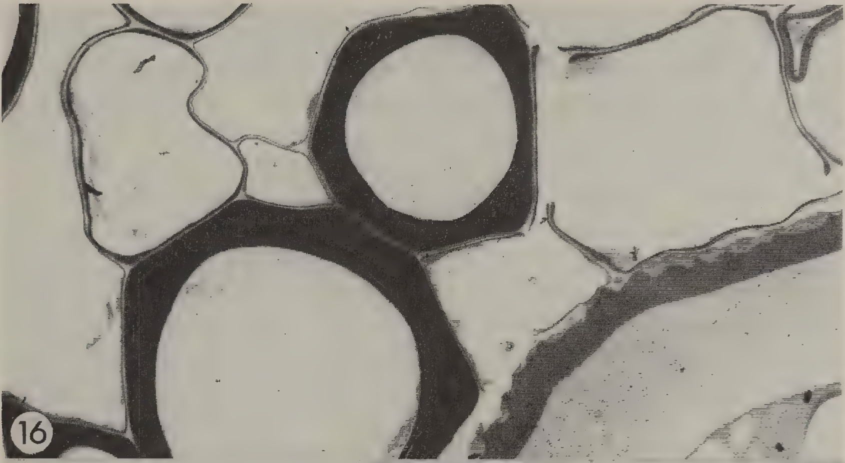
Figs 16 - 18. Transmission electron microscopy of *Endogone alba*. Fig. 16. An ultrathin section showing glebal hyphae with walls of variable thickness and part of the 'zygosporangial' wall which has an outer, fine, discontinuous electron grey layer and an electron dense, dentate inner layer closely adpressed to the electron lucent 'zygospore' wall. x 4350. Fig. 17. A secondary septum in a glebal hypha. x 8700. Fig. 18. A part of a 'zygosporangium' showing the two-layered wall, the 'zygospore' wall and cytoplasm. x 3800.



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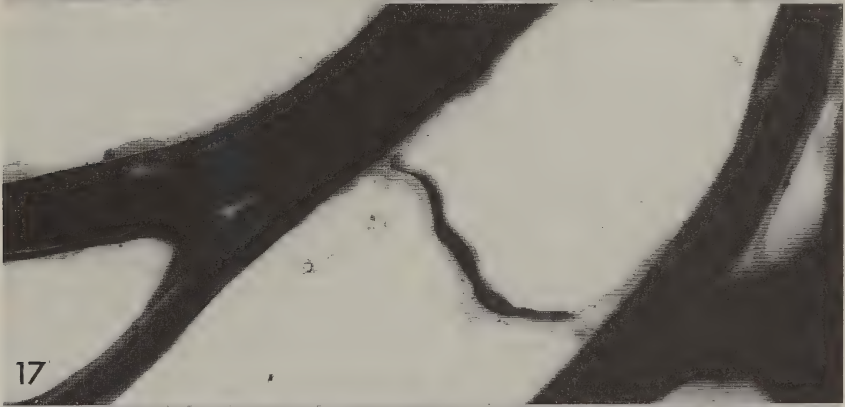

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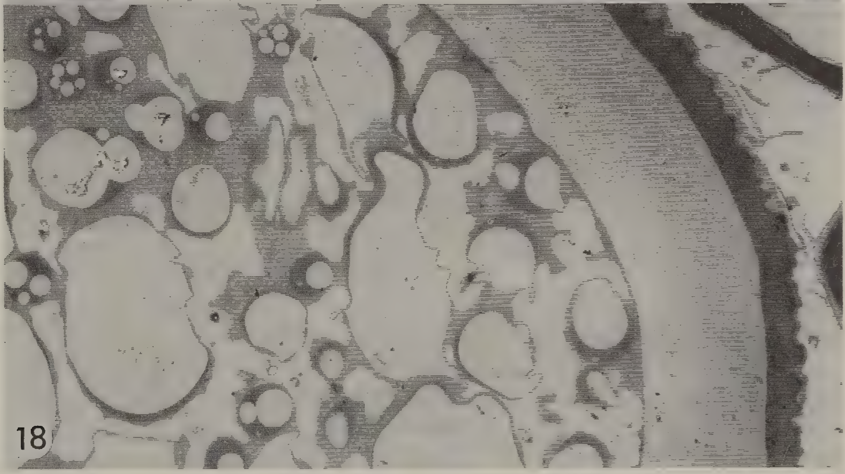

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1.25 x (0.40) - 0.65 - 1.00 mm; yellowish white to pale yellow; hard and tough; aggregated and fused forming multi-sporocarpic cushions; surface tomentose (cottony under a dissecting microscope), with adherent debris of humus and soil. **Peridium** poorly developed, present on exposed surface; pale yellow in transmitted light; 5 - 20 μm thick, with tightly woven, narrow (2 - 4 μm diam.), thin-walled hyphae. **Gleba** pale yellow under reflected light, yellowish white in transmitted light; a zone next to the peridium 50 - 200 μm thick composed mainly of thick-walled (1 - 5 μm) hyphae; inner parts of sporocarp composed of thin- (0.2 - 0.5 μm) to thick-walled hyphae; thin-walled hyphae narrow (3 - 4 μm diam.) to much wider (25 μm diam.); thick-walled hyphae up to 35 μm diam. Thin-walled terminal, curved inflations on thick- or thin-walled hyphae frequently found. **'Zygosporangia'** numerous and scattered irregularly throughout the gleba; subglobose, ellipsoid, obovoid to irregular; 72 - 106 x 62 - 98 μm; yellow to reddish orange; surface with minutely rugulose to almost reticulate ornamentation and often with branching ridges in dried material; sessile to shortly pedicellate. 'Zygosporangium' wall orange to orange red in transmitted light; 0.5 - 2 μm thick, continuous, usually thicker towards the 'zygosporangium' base and thinner apically; outer surface irregularly dentate in sections indicating the surface ridges. 'Zygospore' wall melon yellow in transmitted light; 3.5 - 6 μm thick, continuous, usually protuberant at the junction of attachment. Globules in the cytoplasm yellowish-white to pale-yellow, (1.5) - 4.0 - 5.0 μm diam. Attachment of the 'zygosporangium' thin-walled, continuous with 'zygosporangial' wall, up to 36 μm wide; usually only one seen in thin sections; easily broken at the 'zygosporangium' base; junction 5 - 6 μm wide.

Specimen examined: Sri Lanka, Central Province, Hakgala Botanic Garden, Feb. 1923, Petch (K, holotype).

DISCUSSION

The external appearance of the sporocarp from the type of *E. alba* resembles that of the type collection of *S. coremioides* with a cottony surface formed by a hyphal mass, although that of *E. alba* is slightly lighter in colour and larger in size. Although *S. coremioides* was reported to have fused sporocarps up to 4 deep (Gerdemann & Trappe, 1974; Almeida & Schenck, 1990) most sporocarps of the type are a thin, single layer spread over the substratum comprising

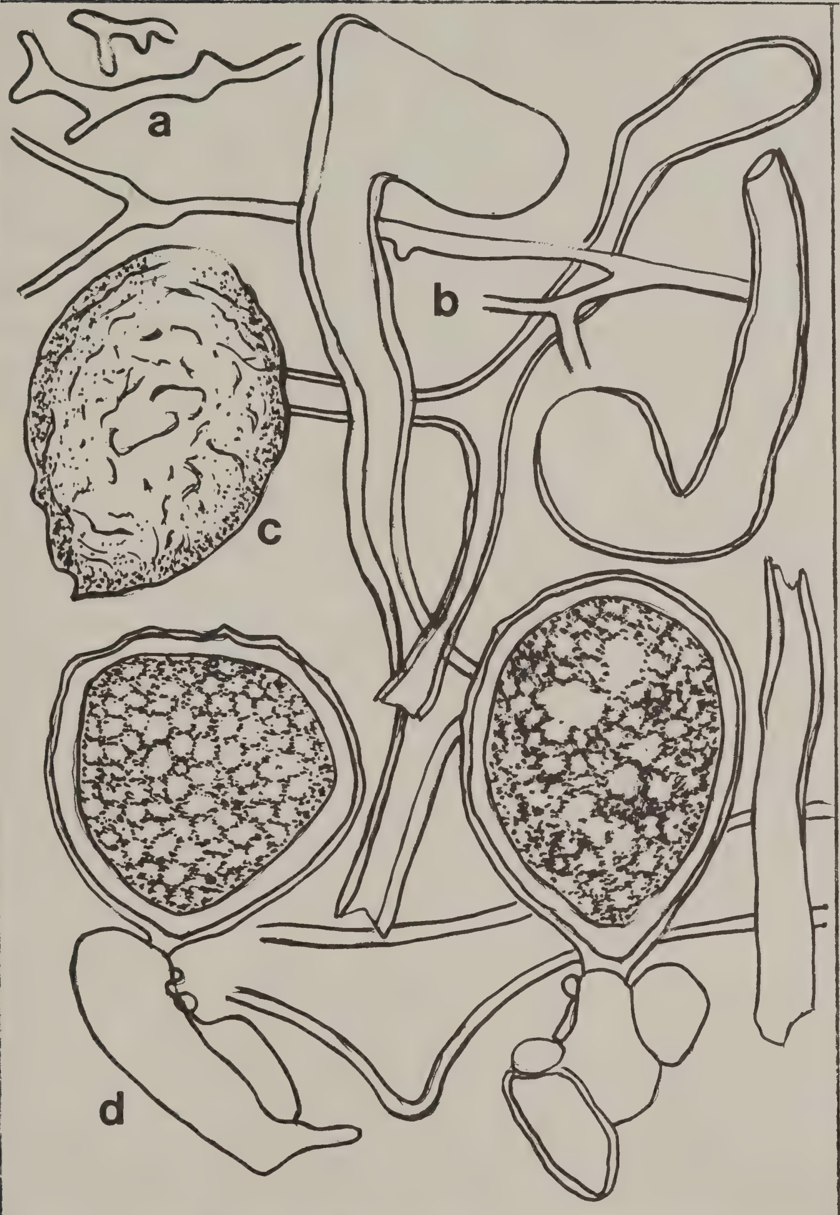

Fig. 19. Camera lucida drawings from the sporocarp of *Endogone alba*. x 500. **a**) Peridial hyphae; **b**) glebal hyphae; **c**) liberated 'zygosporangium'; **d**) 'zygosporangia' in section.

bark and soil. New sporocarps with or without stipe, produced in a manner of buds from a sporocarp, are evident in the type of *S. coremioides*. The sporocarps from the type of *E. alba* are almost in the same stage of development. The morphological differences between *E. alba* and *S. coremioides* are obvious in sporocarp sections. The elongate chlamydospores of *S. coremioides* which form a continuous, single layer radiating from a central hyphal network are absent from the sporocarp base. The spheroidal 'zygospororangia' of *E. alba* are distributed throughout the sporocarp and, unlike the sporocarp of *S. coremioides*, there is no discrete sterile area within the gleba. *Sclerocystis coremioides* was reported as a vesicular-arbuscular mycorrhizal fungus (Gerdemann & Trappe, 1974; Almeida & Schenck, 1990) whereas there is no evidence of a mycorrhizal association in the type of *E. alba*.

As paired gametangia attached to the 'zygosporangium' were not apparent and the stages in development could not be determined from the type material, the true nature of the 'spore' structure remains unknown and it is for the present regarded as a zygosporangium. In view of the continuous walls of the 'spore', this species cannot be placed in either *Sclerocystis* Berk. & Broome or *Glomus* Tul. & C. Tul. as the 'spore' lumen in *E. alba* is never contiguous with that of the attachment element. The 'spores' are neither blastic origin nor are they chlamydospores originating from hyphal enlargements in the sense of *Sclerocystis* and *Glomus*. The broad, aseptate hyphae and putative zygosporangia suggest the zygomycotinous nature of *E. alba*. For the time being, this species is retained in *Endogone* owing to its 'zygosporocarpic' habit. The outer wall layer of the 'spore' is presumed to be a zygosporangial wall, and the inner one the true zygospore wall. According to Warcup (1990), *E. alba* is not related to the recently described *Sclerogone eucalypti* Warcup. Although both *S. eucalypti* and *E. alba* have small, hard, tough zygosporocarps, they are only aggregated and adherent in *E. alba*. Other species with aggregated sporocarps are found e.g. in *Glomus ambisporum* Smith & Schenck, *G. heterosporum* Smith & Schenck and *Sclerocystis rubiformis* Gerdem. & Trappe (=*G. rubiformis* (Gerdem. & Trappe) Almeida & Schenck) which have, however, been reported as having chlamydosporic sporocarps only (Smith & Schenck, 1985).

The dentate appearance of the outer surface of a 'zygosporangium' as seen in freezing-microtome sections (Fig. 5) and broad, branching ridges on the dried 'zygosporangium' (Fig. 13) imply that the larger surface ridges might be caused by wrinkling of the 'zygosporangial' wall, resulting from shrinkage on drying. The glebal hyphae which invest the 'zygosporangium' seen in exsiccate material in the SEM (Fig. 12) are unlike the strongly agglutinated elements which surround the zygosporangium of *E. flammicorona* and the well-defined mantle of *E. lactiflua* as only loosely aggregated hyphae surrounding 'zygosporangia' were observed in sections (Figs 3, 6 - 8) and no evidence of a mantle structure was found in dissected preparations. Possibly, the amorphous, discontinuous outermost layer of 'zygosporangium' wall (Figs 15, 17) is mucilaginous as it has not been detected in the dried SEM preparations.

As only a single element has been observed attached to the wall of the 'zygosporangium' of *E. alba* an implication is that development of the 'zygosporangium' may differ from that of other *Endogone* species where two gametangia preceding zygosporangia formation e.g. *E. flammicorona* and *E. pisiformis* Link : Fr. (Bucholtz, 1912; Thaxter, 1922) have been demonstrated. A possibility is that *E. alba* may be an azygosporic species.

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A NEW SPECIES OF CLAVICORONA FROM JAPAN

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Clavicorona sensu lato (Doty, 1947) comprises a widely distributed group of fungi mostly characterized by their pyxidately branched fruitbodies, gloeoplerous hyphae and amyloid spores (Corner, 1970; Dodd, 1972; Leathers & Smith, 1967; Petersen, 1988). During the course of morphological studies on Asian *Clavicorona* collections, a new species from Japan was found. Intercollection mating tests also revealed that this Japanese species was reproductively isolated from other *Clavicorona* species (Wu & Petersen, 1991). Fruitbody structure, somatic culture mat morphology and mating system of this species are the subject of this paper.

The methods of morphological studies and mating tests have been described by Wu & Petersen (1991). Briefly, color terminology follows that of Kornerup & Wanscher (1978), cited in parenthesis as page, column, row, and Ridgway (1912), cited in quotation marks. Sulfo-benzaldehyde (SBA) solution was used to stain for gloeoplerous hyphae. At least 20 spores were measured per specimen, and subsequently E value (length divided by width), median E value (Em) and median length (Lm) were calculated. Culture studies were carried out following the standard methods described by Nobles (1965) and Stalpers (1978), using dikaryotic mycelia obtained from tramal tissue. The following media were employed for description and comparison: Malt Extract Agar (MA; Difco), Potato Dextrose Agar (PDA; Difco) and Malt Yeast Glucose Agar (MYG; James, 1983). Ethanolic syringaldazine (Harkin & Obst, 1973) and aqueous *p*-cresol (Marr, 1979) were used to detect laccase and tyrosinase activity at Week II and Week VI, respectively. Cultures and voucher specimen were preserved in Botany Department, The University of Tennessee (TENN).

KEY WORDS: *Clavicorona microspora*; taxonomy; cultural mat morphology; mating system.

CLAVICORONA MICROSPORA Wu *et* Petersen *sp. nov.* (Fig. 1)

Basidiomata circa 9 cm alta, 6 cm lata, caespitosa, pyxidata; ramulis, gracilis, infra luteo-albis, supra dilute ochraceo-bubalinis vel dilute subroseo-cinnamominis; apicibus coronatis, acutis, pallide subroseo-cinnamominis; sapore infirme acerbis. Hyphae 1.5-10.0 μm latae, subinflatae, parietibus tenuibus vel parum incrassatis instructae, fibulatae. Hymenium ad 20 μm crassum. Basidia 10-18 X 3.0-4.5 μm, clavata, fibulata. Gloeocystidia 3.0-4.5 μm lata, cylindrica vel ventricosa. Leptocystidia 3-6 μm lata, filamentosa. Sporae 3-4 X 2.0-2.5 (-3.0) μm, anguste ovatae vel ellipsoideae, amyloideae, prope laevigatae, apiculo obliquo instructae.

HOLOTYPUS: Japan, Tochigi Pref., Mashiko town, 1989 IX 29, R. H. Petersen 2349 (TENN 48856).

Fruitbodies 7-9 cm high, 4-6 cm wide, typically pyxidately and very finely branched, cespitose; stipes rare, branched at very base; basal mycelial patch brown ("pecan brown"); branches in up to 7 ranks; lower branches yellowish white (2A2), pale yellow (2A3) to pastel yellow (2A4), upward "pale ochraceous buff" to "pale pinkish cinnamon," with slight tint of flesh or pink; branches slender, crowded; apices coronate, cuspid, last 2-4 mm light orange (5A5) ("pinkish buff" to between "vinaceous buff" and "light pinkish cinnamon"); texture drying fragile; flesh white, inamyloid; taste slowly, weakly acrid.

Tramal hyphae 1.5-10.0 μm wide, inflated, hyaline, clamped, thin- to slightly thick-walled (wall up to 0.7 μm thick), very tightly packed, parallel, not gelatinous. Subhymenial hyphae 1.5-3.5 μm wide, thin-walled, clamped, tightly interwoven, hyaline; gloeoplerous hyphae abundant, 3-8 μm wide, clamped at base, with yellowish, refractive contents, elongated, ending in hymenium as gloeocystidia, staining black in SBA. Hymenium up to 20 μm thick, not gelatinized; basidia 10-18 X 3.0-4.5 μm, thin-walled, hyaline, clamped at base, clavate, (2-)4-sterigmate; sterigmata 2-4 μm long, slightly curved; gloeocystidia, the apical portion of gloeoplerous hyphae, 3.0-4.5 μm wide, projecting up to 16 μm beyond basidia, cylindrical or ventricose; leptocystidia 3-6 μm wide, filamentous, hyaline, projecting up to 13 μm beyond basidia.

Basidiospores 3-4 X 2.0-2.5 (-3.0) μm (E=1.2-2.0, Em=1.5, Lm=3.4 μm), narrowly ovate to ellipsoid, amyloid, white in mass, nearly smooth or slightly asperulous, uniguttulate; apiculus <0.5 μm long, typical of the genus.

HABITAT: On rotten wood.

CULTURE MAT MORPHOLOGY: **On MA**: Colony covering agar surface (100 mm diam) and forming small abortive fruitbodies in five weeks. **Macromorphology:** Advancing zone appressed; margin even to more or less fringed; aerial mycelium poorly developed, silky, hyaline; reverse unchanged; odor similar

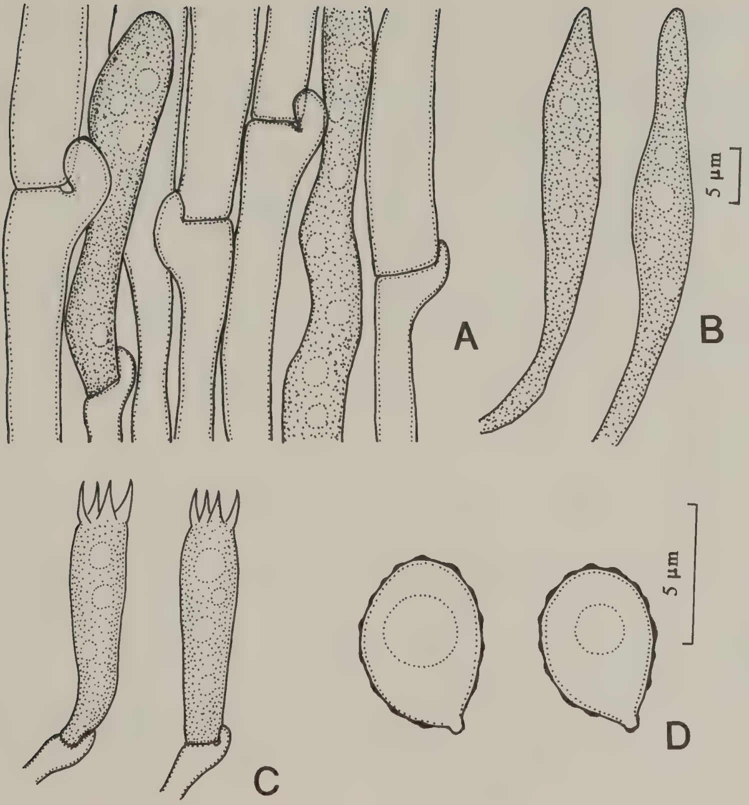

Fig. 1. *Clavicorona microspora*: **A**, tramal tissue with scattered gloeoplerous hyphae; **B**, gloeocystidia; **C**, basidia; **D**, basidiospores. Scale in B applies to A-C. From TENN 48856.

to lemon. **Micromorphology**: Advancing zone hyphae 1.5-5 μm diam, hyaline, infrequently branched, non-amyloid, thin-walled, clamped; aerial hyphae 2-5 μm, thin-walled, hyaline, clamped, loosely interwoven; crystals parallelogram-shaped, abundant. Submerged hyphae 1.5-4 μm diam, hyaline, dextrinoid, loosely interwoven, frequently branched, clamped, with no crystals. Gloeoplerous hyphae rare, up to 5 μm diam, with granular, dense contents. Fruitbodies: hyphae 3-8 μm, inflated, clamped, hyaline, thin- to slightly thick-walled (wall < 1 μm thick), densely packed, parallel; gloeoplerous hyphae abundant, 3-8 μm diam; basidiospores absent. **Phenoloxidase Reactions**: Week II: Laccase + +, Tyrosinase –. Week VI: Laccase +, Tyrosinase –. **Nobles Code**: 2a. 3c. 9. 22. 25. 26. 32. 36. 38. 45. 48. 50.

60. **Stalpers Code:** 1. 9. 11. 13. 30. 36. 37a. 39. 45. 48. 53. 61. 65. 73. 80. 83. 94. 95. 97. 99.

On PDA: Colony covering agar surface in six weeks. **Macromorphology**: Advancing zone appressed; margin even to more or less fringed, silky; aerial hyphae silky, pale orange (5A3), more or less zonate and radial; reverse brown in center, light brown at margin; odor medicinal. **Micromorphology**: Advancing zone hyphae 1.5-3 μm diam, hyaline, thin-walled, clamped; aerial hyphae 2-6 μm diam, inflated, consisting of shortened cells, thin- to slightly thick-walled (wall < 1 μm thick), hyaline, clamped, densely packed, *textura epidermoidea*. Submerged hyphae 2-5 μm diam, dextrinoid, infrequently branched, clamped, loosely interwoven, without crystals. Gloeoplerous hyphae 3-6 μm diam, with spherical swellings up to 15 μm, yellowish. **Phenoloxidase Reactions**: Week II: Laccase + +, Tyrosinase + + +; Week VI: Laccase +, Tyrosinase + + +. **Nobles Code:** 2. 3c. 9. 22. 25. 26. 32. 37. 39. 46. 48. 53. 60. **Stalpers Code:** 1. 9. 11. 13. 29. 35. 38. 39. 45. 48. 53. 61. 65. 73. 80. 83. 94. 95. 97. 99.

On MYG: Colony covering agar surface in six weeks. **Macromorphology**: Advancing zone appressed; margin more or less fringed, silky; aerial mycelium woolly, white; reverse brown in center to light brown at margin; odor not distinctive. **Micromorphology**: Advancing zone hyphae 1.5-3 μm diam, as on PDA; aerial hyphae 3-6 μm diam, clamped, slightly thick-walled (wall < 1 μm thick), densely packed; spherical swollen hyphae up to 10 μm diam, intercalary or terminal; thick-walled hyphae (wall > 1μm thick), 2-5 μm diam, unbranched, elongate. Submerged hyphae 2-8 μm diam, dextrinoid, hyaline, infrequently branched, loosely interwoven, without crystals. Gloeoplerous hyphae 3-6 μm diam in advancing zone, but absent in submerged hyphae. **Phenoloxidase Reactions:** Week II: Laccase +, Tyrosinase + + +; Week VI: Laccase +, Tyrosinase + + +. **Nobles Code**: see PDA. **Stalpers Code:** 1. 9. 11. 13. 22. 29. 35. 38. 39. 45. 48. 53. 61. 65. 73. 80. 83. 94. 95. 97. 99.

MATING SYSTEM: Single-spore isolates of two *Clavicorona microspora* collections were used for mating system tests, one accompanied by a specimen (No. 2349), another from only a spore print (KY5352). Self-crosses revealed a bifactorial (tetrapolar) mating system pattern for both collections. All single-spore isolates segregated into one of the four mating types.

The single spore matings produced four types of reactions. **Compatible matings**: Hyphae from donor mycelia were smoothly intermingled and formed an undifferentiated contact zone. Clamp connections first were formed in the contact zone, then were produced all over both mycelia within 4 weeks. **"Flat" reactions**: Mycelia from both donors were intermingled, but hyphae became sparse in the contact zone, clamp connections were absent. **"Barrage" reactions:** Hyphae from donor mycelia were raised and formed a clear contact zone. False clamp connections were not observed. **Incompatible pairings:** This type of reaction was morphologically similar to a compatible mating, but no clamp connections were observed.

Intercollection matings: Matings between tester strains of collection 2349 and KY5352 showed that these two collections were fully compatible. In all pairings, clamp connections were formed all over the donor mycelia within four weeks. In some matings, fruitbodies were produced. These were small, crowded, up to 1 cm high, cream colored upward and tan downward. Basidiospores were shed to the top of plates and deposited in white spore prints. Basidiospores collected from these spore prints germinated at nearly 100%. Self-crosses using the single-spore isolates obtained from those germinated basidiospores revealed a typical bifactorial mating system pattern (Wu & Petersen, 1991).

DISCUSSION: Fruitbodies of *Clavicorona microspora* are characterized by crowded, pyxidate, fine branches with light orange colored apices; drying fragile; extremely abundant gloeoplerous hyphae; short basidia and very small basidiospores. Presently this species has been found only in Japan. *Clavicorona pyxidata* (Pers.: Fr.) Doty is the only *Clavicorona* previously reported from Japan (Imazeki *et. al.*, 1988). These two species are similar in fruitbody appearance, but the light orange color of apices of *C. microspora* are unique and its basidiospores are shorter and broader than those of *C. pyxidata* (Em=1.8, Lm=4.7 μm). The basidiospores are the smallest reported in the genus.

Dodd (1972) suggested that *C. candelabrum* (Massee) Corner was distinct from others in the genus because of the presence of thick-walled hyphae in the basidiomata, but Petersen (1985) did not find thick-walled hyphae in the type specimen of *C. candelabrum*. Petersen (1985) described the type specimen as small fruitbodies (20 X 12 mm dry) which dry brown-black and cartilaginous. In contrast, *C. microspora* has relatively large, crowded-branched fruitbodies and remained yellowish when drying. Likewise, *Clavicorona microspora* is different from *C. turgida* (Lév.) Corner in the lighter color of basidiomata, slender branches, non-gelatinous hyphal texture and smaller basidiospores.

The culture mat of *C. microspora* was characterized by fruitbody formation on MA within five weeks, and abundant crystal formation. Gloeoplerous hyphae were abundant in fruitbodies formed on the agar surface, but rare in aerial or submerged culture hyphae. Abundant crystals appeared at Week VI. On all three media submerged hyphae were dextrinoid, but not aerial hyphae. Overall, culture mat morphology of *C. microspora* is similar to that of *C. pyxidata* in growth rate, color and texture on MA, but the latter never formed fruitbodies on MA.

The bifactorial mating system of *C. microspora* is typical of the genus (Wu, 1991). The full compatibility between the two Japanese collections indicated that monokaryotic strains of these collections were physiologically fertile, *i. e.* able to form dikaryotic hyphae when mated with genetically compatible isolates. Previous study revealed that matings between *C. microspora* isolates and *C. pyxidata* isolates from China and North America were all incompatible and showed strong antagonism phenomena (Wu & Petersen, 1991). Hence, morphological differentiation was accompanied by reproductive isolation.

Genetic variation among the species of *Clavicorona* was observed in results of enzyme analysis (Wu, 1991). Electrophoretic banding patterns of extracellular laccase in *Clavicorona* were different among species but consistent within species (Wu, 1991). Laccase electropherograms produced by *C. microspora* were characterized by a two-band pattern, in contrast to the one-band pattern of *C. pyxidata*, and more interestingly, one of the two bands had a identical mobility to that of the standard band produced by *C. pyxidata* collections.

Although *Clavicorona pyxidata* is a widely distributed Northern Hemisphere species and previously reported from Japan (Imazeki *et al.*, 1988), we did not collect any Japanese specimens. *Clavicorona microspora* represents a morphologically differentiated species supported by mating incompatibility and isozyme banding differences. Nevertheless, further study to assess the occurrence of *C. pyxidata* in Japan and to demonstrate the relationship between these two species will be interesting.

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WEST AFRICAN POLYPORES: NEW SPECIES AND COMBINATIONS

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SUMMARY

Four new polypore species found in West African tropical countries are described, *viz.*, **Flaviporus delicatus**, **F. xanthus**, **Pachykytospora nanospora** and **Schizopora cystidiata**. **Coriolopsis ekunduensis** (Henn.), **Funalia telfarii** (Kl.) and **Skeletocutis diluta** (Rajchenb.) are new combinations and are redescribed.

INTRODUCTION

The tropical African Polypore Flora is mainly known by the work of Ryvarden & Johansen (32). During a survey of Polypores collected in several West African tropical countries by colleagues attached to the Mycology Laboratory at Claude Bernard Lyon I University, France, some new or little known species were found which are herein described.

MATERIALS AND METHODS

Microscopic examination of the fruitbodies, measurements and drawings were made from freehand sections mounted in 5% KOH aqueous phloxine solution. Color notations were made according to Munsell (23). Herbarium abbreviations are from

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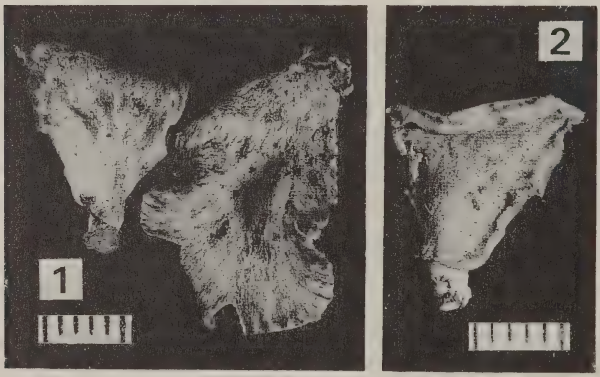
Holmgren & Keuken (20). In addition, LY AD- refers to the herbarium of A. David which is at Lyon I University. LY AD-sn refers to collections that were not given a herbarium number. Cultural studies followed Boidin's methodology and nomenclature (1, 2).

RESULTS

FLAVIPORUS DELICATUS David & Rajchenb. sp. nov.

Basidiocarpo annuo, diminuto, flabellato, in vivo carnoso acquosoque, in sicco duro. Pileo stramineo pallido, contexto sanguineo umbrino. Poris 13-15 per mm, albis. Systema hypharum monomiticum, hyphis generativis fibulatis vel afibulatis metachromatisque, in substantia resinosa immersam et non discedens. Basidiis claviformibus 10-12 x 4-5 µm; basidiosporis subglobosis 3-3.5-(4) x 2.5-3-(3.5) µm, hyalinis acyanophilis. Holotypus LY, Herb. A. David 1046.



Figs. 1-2, **Flaviporus delicatus**. 1. Pileus surface (left LYAD 1046; right LYAD 1731). 2. Pore surface, with dorsal marginal stem (LYAD 1046). Scales in mm.

Fruitbody annual, small, flabellate, up to 3-5 x 2.5 x 0.4-0.5 cm in fresh condition, shrinking when dry, water soaked when fresh attached to the substrate by a small dorsal marginal stem or mucro (Fig. 1). Pileus azonate, cottony to irregularly tomentose, pale yellowish (2.5Y8/4, 10YR8/4), weathering to glabrous towards the margin. Margin and exposed context dark and dusky red (10R3/4-6). Margin present around all the pileus (Fig. 2), thin and waxy when dry, incurved in the growing portion. Context thin, not more than 1 mm thick, waxy, cartilagineous and rigid. Tubes short, up to 1.5 mm long, consistency woody, white when fresh. Trama watersoaked and translucent when fresh and young, becoming impregnated with a resinous substance when mature and then becoming reddish chestnut and cartilaginous. Pores 13-15 per mm, round to angular; dissepiments white.

Hyphal system monomitic. Context and tomentum formed by generative hyphae with simple septa and clamp connections on the same hyphae or only simple septate, 3-5 µm diam., delicate, with hyaline walls which may be thin or slightly thick-walled but which appear thicker, up to 2 µm thick, because of the intense impregnation with a yellowish resinous substance (Fig. 3a). Trama consisting of simple septate generative hyphae, with similar wall features, 3-4 µm diam. (Fig. 3b). All the fruitbody hyphae are much cemented by a resinous matter, and their dissociation is very difficult[1]. Hyphae of the context metachromatic in cresyl-blue. **Gloeopleurous hyphae** present in the context, 3-6 µm diam. (Fig. 4a) and among the tomental hyphae, 8-15 µm diam. (Fig. 4b). Polyhedric crystals present in the dissepiments and among the tomental hairs. Dissepiments sterile. **Basidia** claviform, 10-12 x 4-5 µm, with simple septa at the base. **Spores** subglobose to broadly ellipsoid, 3-3.5-(4) x 2.5-3.0-(3.5) µm, hyaline, IKI -, acyanophilous (Fig. 5). **Cystidia** absent.

Materials studied: LY AD-1046, Gabon, Makokou, leg. A. David, VII.1970 (holotype); LY AD-2081, ibid., left shore of the Ivindo River, on Musanga sp. trunk, leg. J. Boidin D48, 18.V.76; LY AD-1731, Gabon, Ipassa, leg. J. David, XII.74 .

Remarks: The following features warrant the inclusion of the new taxon in *Flaviporus* Murr., as defined by Ginns (18): a thin flabelliform fruitbody, small pores, consistency cartilaginous becoming horny when dry, hyphae strongly agglutinated and very difficult to dissociate, and small, hyaline, broad ellipsoid to subglobose spores. The monomitic hyphal system is exceptional within the genus as most other species of the genus are dimitic with clamped generative hyphae and skeletal hyphae (18). *Flaviporus venustus* David & Rajchenb. and *F. hydrophilous* (Berk. & Curt.) Ginns are also monomitic but their fruitbodies are larger and the generative hyphae are clamped at all septa. *Flaviporus subundatus* (Murr.) Ginns has simple septate generative hyphae plus skeletal hyphae and, probably, its affinities are within the genus *Rigidoporus* Murr. (11).

The new species is distinct within the genus on account of its small, delicate fruitbodies, the hairy pileus, the incrusted dissepiments and by its generative hyphae with simple and clamped septa.

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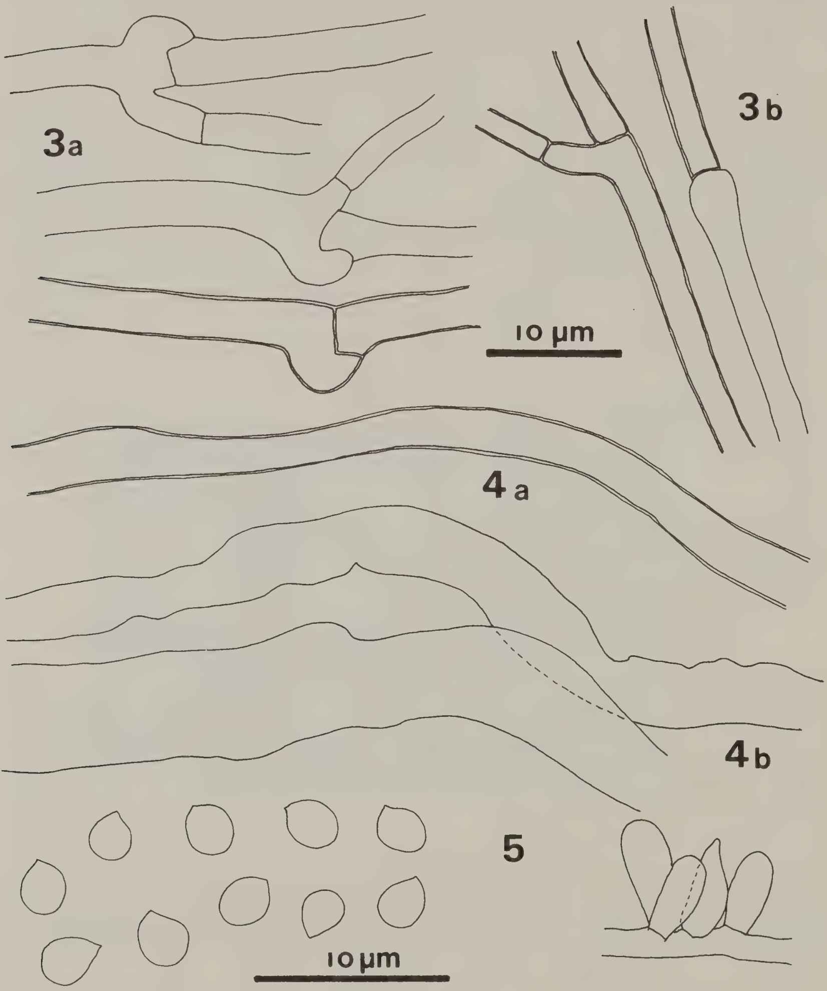
[1] The absence of clamps in the generative hyphae and the absence of skeletal hyphae was verified after overnight treatment of the tissues with ammoniacal Congo Red at 60 ºC, which makes easier the separation of the hyphae.

As understood here *Flaviporus* is still a heterogeneous genus. It encompasses dimitic and monomitic species with strongly agglutinated hyphae that make the discernment of the hyphal system very controversial in some cases. Most of the species present thin cartilagineous pilei, small pores,



Figs. 3-6, **Flaviporus delicatus** (from LYAD 1731). 3. Genera-tive hyphae, a) clamped and simple septate hyphae from the context and tomentum, b) simple septate hyphae from the dissepiments. 4. Gloeopleurous hyphae, a) from the context and b) from the tomentum. 5. Basidioles and basidiospores.

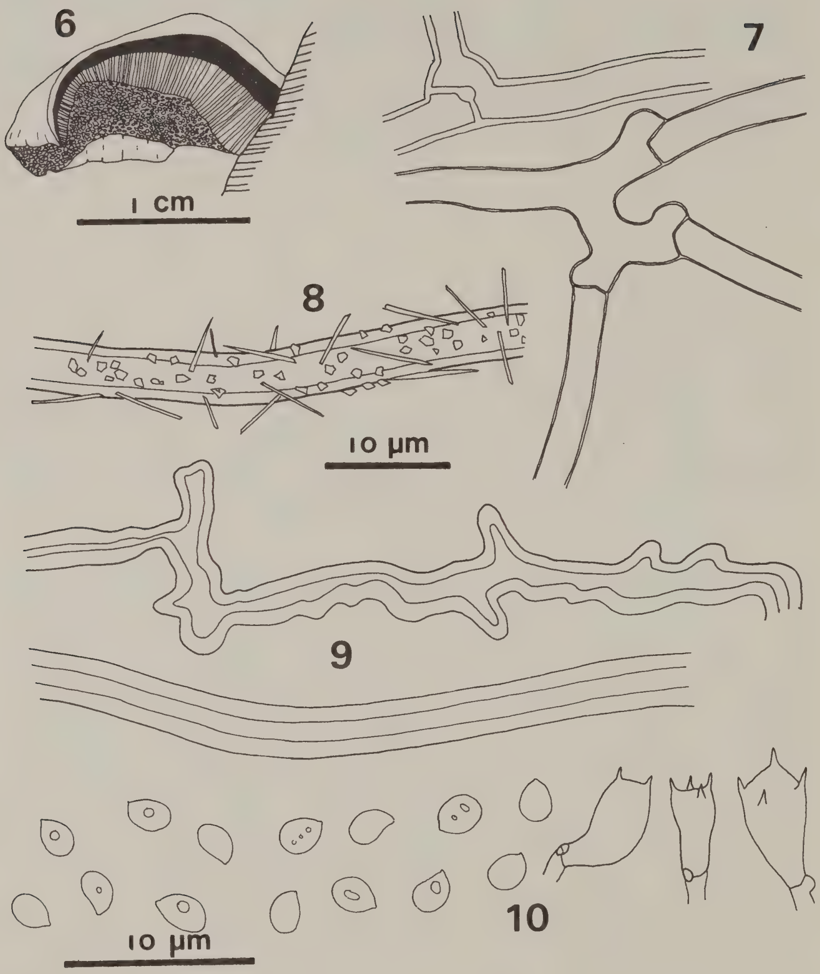
small broadly ellipsoid to subglobose spores and a tropical distribution. The type species *F. brownei* (Pers.) Donk has tramal incrusted cystidia, a character that may relate it to *Junghuhnia* Corda. Most of the other species in the genus lack cystidia, with the exception of *F. subundatus*. Creating a new genus for the acystidiate taxa would not solve the heterogenity of the group in relation with mitism and hyphal septation. Incorporating the species to *Antrodiella* Johans. & Ryv. (32) would bring instability to it, created to accomodate the *Polyporus semisupinus* Berk. & Curt. species' complex (13, 16, 22, 24 and 25).

FLAVIPORUS XANTHUS David & Rajchenb. *sp. nov.*

Basidiocarpo annuo, flabellato vel campanulato, 2-2.5 x 5 x 0.5 cm, glabro, flavo; contexto duplo 2 mm crasso, strato supero suberoso, flavo, rubescenti cum solutione KOH 5% strato infero cartilaginoso vel corneo, badio; pori 6-7 per mm. Systema hyphale dimiticum, hyphae generatoriae fibulatae 3-5 µm latae, ramosae, crassitunicatae, incrustatae; hyphae skeleticae 4-5 µm latae, crassitunicatae. Basidia clavata 7-10 x 3-5 µm; sporae ellipsoideae vel late ellipsoideae 2.5-3 x (1.5)-2 µm, hyalinae. Holotypus LY, Herb. A. David 1041.

Fruitbody annual, flabellate, sessile but narrowing laterally or attached to the substrate by a lateral mucro and then somewhat campanulate; up to 2.5 cm wide, 5 cm rad. and 0.5 cm thick. Pileus convex, upper surface slightly pubescent with agglutinated hairs, sometimes radially undulated or wrinkled when dryed, azonate, light chrome yellow (5Y9/4) sometimes becoming darker or chestnut yellowish upon drying (7.5YR5/8-6/8) and then, slightly zonated; reddening in KOH. Context duplex, up to 2 mm thick (Fig. 6). Upper stratum corky and concolorous with the abhymenial surface, also reddening in KOH. Lower stratum cartilaginous to horny, forming a relatively thick, chestnut (10YR4/4) line. Tubes light alutaceous to buff (10YR8/4), up to 3 mm long. Pores round to angular, 6-7 per mm, concolorous with the tubes. Margin thin, sterile. Dissepiments pubescent to felty.

Hyphal system dimitic. Generative hyphae 3-5 µm diam., clamped, branched, with hyaline, thin to slightly thickened (up to 1 µm) walls (Fig. 7). In the upper context they may be incrusted with granular to acicular yellowish crystals (Fig. 8). Skeletal hyphae 4-5 µm diam., with hyaline thickened walls, generally with a visible clamp at the base, straight, rarely branched but frequently tortuous and with short lateral branches (Fig. 9), present in the lower context and the trama of the tubes and absent from the upper context. Basidia claviform, 7-10 x 3-5 µm. **Spores** ellipsoid to broadly ellipsoid (2.5)-3 x (1.5)-2 µm, abundant, hyaline, some with an oily drop in the cytoplasm (Fig. 10). **Cystidia** absent.



Figs. 6-10, **Flaviporus xanthus** (from LYAD 1053). 6, Drawing of vertical section showing the duplex context with darker and resinous lower stratum. 7, Clamped generative hyphae with distinct walls. 8, Incrusted portion of generative hypha. 9, Skeletal hyphae. 10, Basidia and basidiospores.

Materials studied: LY AD-1041, Gabon, Ipassa, Makokou, leg. A. David, VII.1970 (holotype); LY AD-1053, ibid., leg. ipse; LY AD-1734, ibid., leg. J. David, X.1974; LY AD-sn, ibid., leg. A. David.

Remarks: The distinctive features of this species are the yellowish coloration of the fruitbody, the duplex context and the reddening of the pileus with 5% KOH. *Antrodiella citrea* (Berk.) Ryv. exhibits a similar coloration of the fruibody but, according to the description given by Ryvarden (30) differs by its narrowly sulcate pileus, somewhat smaller pores, viz. 6-8 per mm, the homogeneous context, the wider generative hyphae 2-8 µm diam., the straight and unbranched skeletal hyphae and by the lack of a reddening reaction of the pileus with KOH solution. Several species have been described by Corner (5) with flabellate fruitbodies, yellowish hymenial surface, small pores and spores, and a dimitc hyphal system. These species have been described in an enlarged concept of the genus *Flabellophora* G.H. Cunn. and do not fit our description of the new species. *Flabellophora aurantiaca* Corner, described from the Solomon Is., differs by its short thick stem from which imbricate pilei develop; the pilei have a pale orange buff coloration and are thicker, viz. 6-10 mm thick, and the tomentum (upper context ?) is dimitic and not monomitic as in our species. *Flabellophora flaviporus* Corner, described from Malaya, differs in its pale rufous pilei, yellowish tubes and dissepiments, a dimitic hyphal system with skeletal hyphae and by pip-shaped to ellipsoid, larger spores, 3-3.7 x 2-2.5 µm.

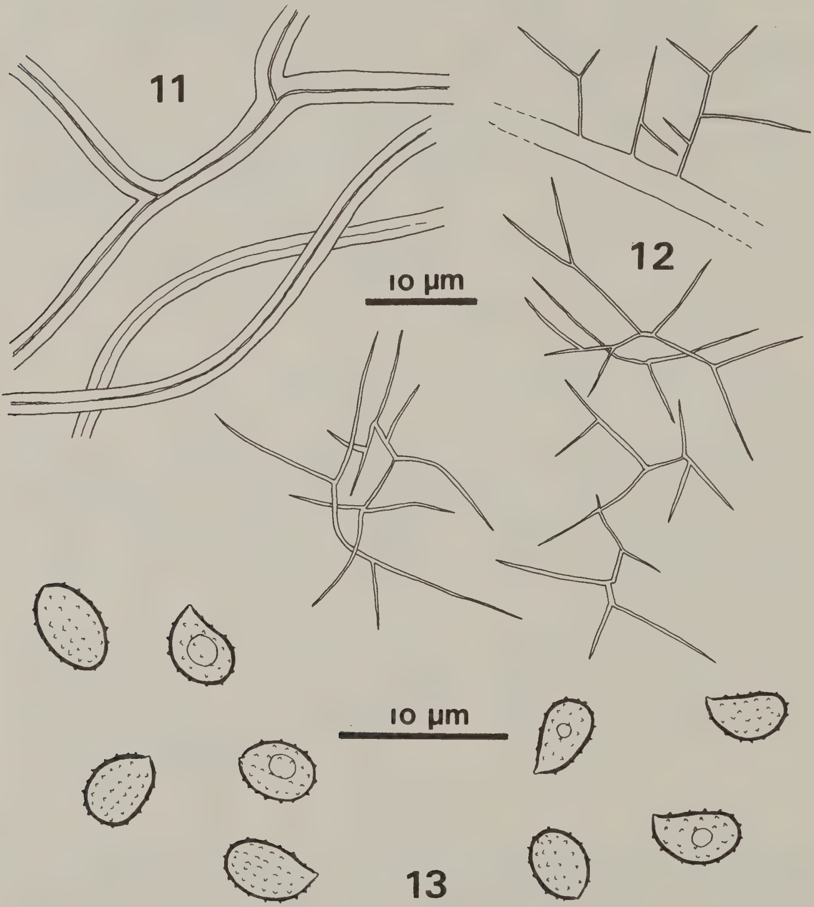
PACHYKYTOSPORA NANOSPORA David & Rajchenb. *sp. nov.*

Basidiocarpo resupinato, annuo vel perennis, coriaceo, cremeo; poris 7-8 per mm. Systema hypharum trimiticum; hyphae generatoriae fibulatae, 1.5-2 µm diam., hyphae skeleticae 1.5-2.5 µm diam., crassitunicatis, dextrinoideis, cyanophilicisque, hyphae colligantes ramosae 0.5-(1) µm diam., arachnoideae. Basidiis claviformis, tetrasporis, 12-17 x 5-9 µm. Sporis ellipsoideis 5-6-(6.5) x 3-4 um, parietes leviter incrassatis verrucosis striisque, cyanophilis. Holotypus LY, Herb. A. David 2368.

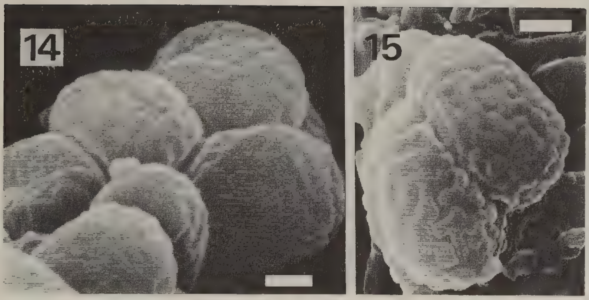
Fruitbody resupinate, adhering to the substrate, annual to perennial, up to 3 mm thick. Margin distinct, sterile, felty. Hymenial surface cream to beige when dry. Pores round, 7-8 per mm. Tubes concolorous, up to 1.5 mm long. Context slightly darker, dark cinnamon, up to 0.3 mm thick.

Hyphal system trimitic. Generative hyphae regularly clamped, 1.5-2 µm diam., thin-walled. Skeletal hyphae 1.5-2.5 µm diam. (but up to 4 µm diam. in 5% KOH) not branched or poorly so, generally with a lumen, walls thickened, strongly dextrinoid and cyanophilous (Fig. 11). Prismatic to irregularly shaped crystals up to 15 µm long scattered in the tubes' trama. Binding hyphae very thin 0.5-(1) µm diam., profusely branched, acicular, not coralloid, arachnoid, apparently originating at the sides of generative hyphae, abundant (LYAD 2044) or scarce (LYAD 2368) (Fig. 12). **Basidia** claviform, 12-17 x 5-9 µm, tetraspored. **Cystidia** absent. **Spores** ellipsoid 5-6-(6.5) x 3-4 µm, IKI -, cyanophilous, with slightly thickened walls, asperulated under light microscope: spores with cytoplasm appear almost smooth but empty ones appear more or less distinctly asperulate (Fig. 13) and, when viewed with SEM, they appear warty with rounded and more or less alongated ridges (Figs. 14-15).

Materials studied: LY AD-2368, Gabon, Libreville, Fôret de La Mondah, km 27.5 N of Libreville, leg. G. Gilles, 20.XI.77 (holotype); LY AD-2399, ibid., km 16 N of Libreville, leg. ipse nº 323, 17.XII.77; LY AD-2044, Gabon, Makokou, leg. J. Boidin D7, 5.V.76; LY AD-1024, ibid., leg. A. David, VII.70 .



Figs. 11-13, **Pachykytospora nanospora**. 11, Skeletal hyphae. 12, Binding hyphae. 13, Basidiospores, a) from LYAD 2044, b) from the holotype LYAD 2368.



Figs. 14-15, **Pachykytospora nanospora**. 14, SEM photograph of basidiospores from LYAD 2044. 15, SEM photograph of basidiospores from LYAD 2368. Bar = 1 µm.

Remarks: The new taxon is unique in the genus because of its small pores, small spores and strongly dextrinoid skeletal hyphae. The spores do not have striated ridges as in the type species, *viz. Pachykytospora tuberculosa* (DC:Fr.) Kotl. & Pouz. (29, fig. 106), but the warts do appear one after the other, they tend to coalesce and may exhibit rounded ridges as in *P. alabamae* (Berk. & Curt.) Ryv. (28, pl. IXb).

The strong dextrinoid reaction of the skeletal hyphae in the new taxon is paralleled by the weak dextrinoid reaction previously recorded for other species in the genus (17). Also, neotropical specimens of *Pachykytospora alabamae* from French Guiana, southern Brazil and northeastern Argentina at BAFC show a strong dextrinoid reaction in the individual skeletal hyphae, at least in those of the trama. Dextrinoidity of the skeletal hyphae is a variable character within several polypore genera, viz. *Perenniporia* Murr., *Rigidoporus* Murr., *Ganoderma* Karst., *Amauroderma* Murr. (3), *Polyporus* Fr. (4), *Wrightoporia* Kotl. & Pouz. (12) and *Trametes* Fr. (7). In these genera the reaction is present in some species but is lacking in others. *Pachykytospora nanospora* adds a new example to this list. Therefore, the dextrinoid reaction of skeletal hyphae should be used with caution when defining genera in the Polyporaceae.

Binding hyphae are similar, if not identical, to those present in *Tyromyces merulinus* (Berk.) G.H. Cunn., as described by Corner (6) and figured by Rajchenberg (26). Similar hyphae are found in neotropical specimens of *Perenniporia medulla-panis* (Jacq.: Fr.) Donk and *Pachykytospora alabamae* (Berk. & Curt.) Ryv.

Ryvarden (31) described the genus *Murrilloporus* to accomodate a Mexican polypore, viz. *Trametes rutilantiformis* Murr., which, though being pileated, exhibits microscopic features similar to those of *P. nanospora*, i.e., small, asperulated, ellipsoid spores with hyaline, slightly thickened walls which appear warted under the SEM, and strongly dextrinoid hyphae. The spore warts of the Mexican species appear more distinct and not elongated as in the African species and the others described in *Pachykytospora*.

SCHIZOPORA CYSTIDIATA David & Rajchenb. *sp. nov.*

Basidiocarpo annuo, resupinato vel effuso reflexo; pileo angusto, tomentoso fibrilloso, albido vel cremeo; poris 2-3 per mm. Systema hypharum monomiticum, hyphae generatoriae fibulatae 3-5 µm diam., tenuitunicatae vel crassitunicatae. Basidiis suburniformibus 10-12 x 4-5 µm, sporis ovoideis 5-6 x 3-4 µm, tenuitunicatae, hyalinis, acyanophilis, inamyloideis, cystidiis incrustantes. Holotypus LY, Herb. A. David 2744.

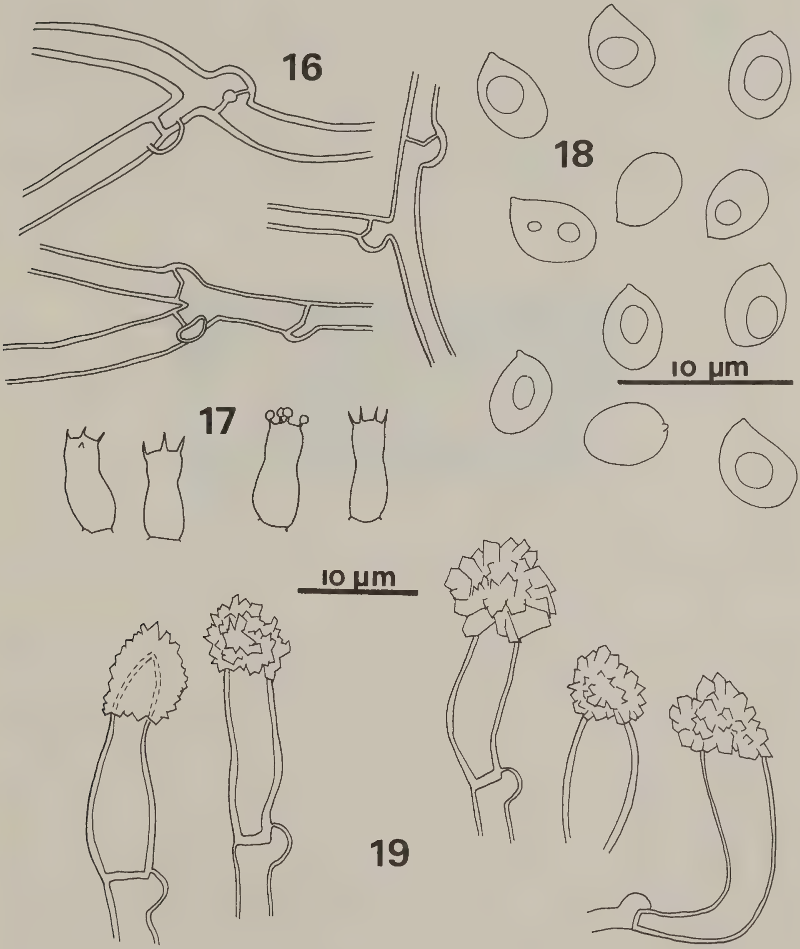
Fruitbody annual, resupinate to effused-reflexed and then forming an elongated narrow pileus. Pileus up to 0.7 cm in radius, tomentose, scrobiculate, fibrillose, very light in weight, 2-3 mm thick, milky white when fresh, light ochraceous (2.5YR9/4-9/6) when dry, hymenial surface concolorous. Pores 2-3 per mm, sometimes more or less concentrically arranged. Context cottony, up to 2 mm thick in the pileus but very thin in the resupinate fruitbodies, not more than 0.3 mm thick. Tubes short up to 0.5 mm long.

Hyphal system monomitic. Generative hyphae hyphodontioid, clamped, 3-5 µm diam., walls thickened to 1 µm, clamps small and hemispheric; hyphae loosely interwoven (Fig. 16). **Basidia** suburniform, tetraspored, 10-12 x 4-5 µm (Fig. 17). **Spores** ovoid to ellipsoid, 5-6 x 3-4 µm, thin-walled, generally with an oil drop in the cytoplasm, IKI −, acyanophilous (Fig. 18). **Cystidia** hymenial, cylindric, lageniform or mammiform, 15-20 x 5-6 µm, apically incrusted, with thickened walls up to 1 µm thick (Fig. 19). Lageniform thin-walled cystidiols also present.

Materials studied: LY AD-2744 Reunion I., Tévelave, leg. A. David, 4.IV.1987 (holotype); LY AD-2742, ibid., Maïdo, 1600 m, leg. ipse, 20.III.1987; LY AD-2743, ibid., Roche Merveilleuse, leg. ipse, 2.V.1987; LY AD-2554, ibid., Mare à Montfleury, leg. J. Boidin, 21.IV.1985; LY AD-1695, Maurice I., des Macabées Forest, leg. A. David, 22.VIII.1973; LY AD-1540, Congo (Brazzaville), Brazzaville, leg. J. David, XII.1974.

Remarks: The species is easily recognized by its light weight and the apically incrusted hymenial cystidia. Other species in the genus, *viz. Schizopora flavipora* (Cke.) Ryv., *S. paradoxa* (Schrad.: Fr.) Donk and *S. apachariensis* (Gilbn. & Canf.) Gilbn. & Ryv. have thin-walled cystidioles and/or hyphal tips which are irregularly incrusted in the apex and/or along their length, but distinct hymenial cystidia, as those present in *S. cystidiata*, are lacking. In culture (David, unpublished) the mycelium of the new species develops drepanocysts as do many *Hyphodontia* J. Erikss. species (19). This fact suggests a close relationship between the polyporoid *Schizopora* Vel. and the corticioid

Hyphodontia, as has been already pointed out several times (15 and 17, among others). The inclusion of this species in *Schizopora* is mainly based on its poroid hymenophore with sterile dissepiments. The holotype has been chosen from the Reunion Is. materials because the species is fairly common in those islands.



Figs. 16-19, **Schizopora cystidiata** (from LYAD 1695). 16, Generative hyphae. 17, Basidia. 18, Basidiospores. 19, Cystidia.

CORIOLOPSIS EKUNDUENSIS (Henn.) David & Rajchenb. *comb. nov.* Basionym: *Polystictus ekunduensis* P. Henn., Engl. Jahr. Bot. 22: 91, 1895.

Fruitbody annual, solitary or in groups, pileate, dimidiate, applanate, thinning towards the margin, up to 9 cm wide, 4.5 cm radius and 0.4-0.6 cm thick, coriaceous. Pilei dark brown (7.5YR4/4 and 3/2), dark reddish brown (5YR3/4) or dark grayish brown (10YR4/2), faintly zonated, typically with creamish to brownish warts and/or outgrowths scattered in the pileus but more abundant towards the base (Fig. 20). Pilei velutinate, becoming glabrous. Margin cream coloured and, therefore, distinct and contrasting with the remaining abhymenial surface. Pores round to polygonal, 3-4.5 per mm; dissepiments thick, entire and round. Pore surface cream coloured (5YR8/1), contrasting with the dark brownish context and tubes, darkening upon drying (5YR7/2). Context up to 2 mm thick, tubes up to 5 mm long.

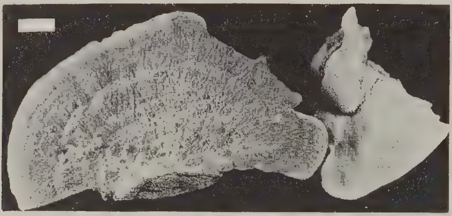
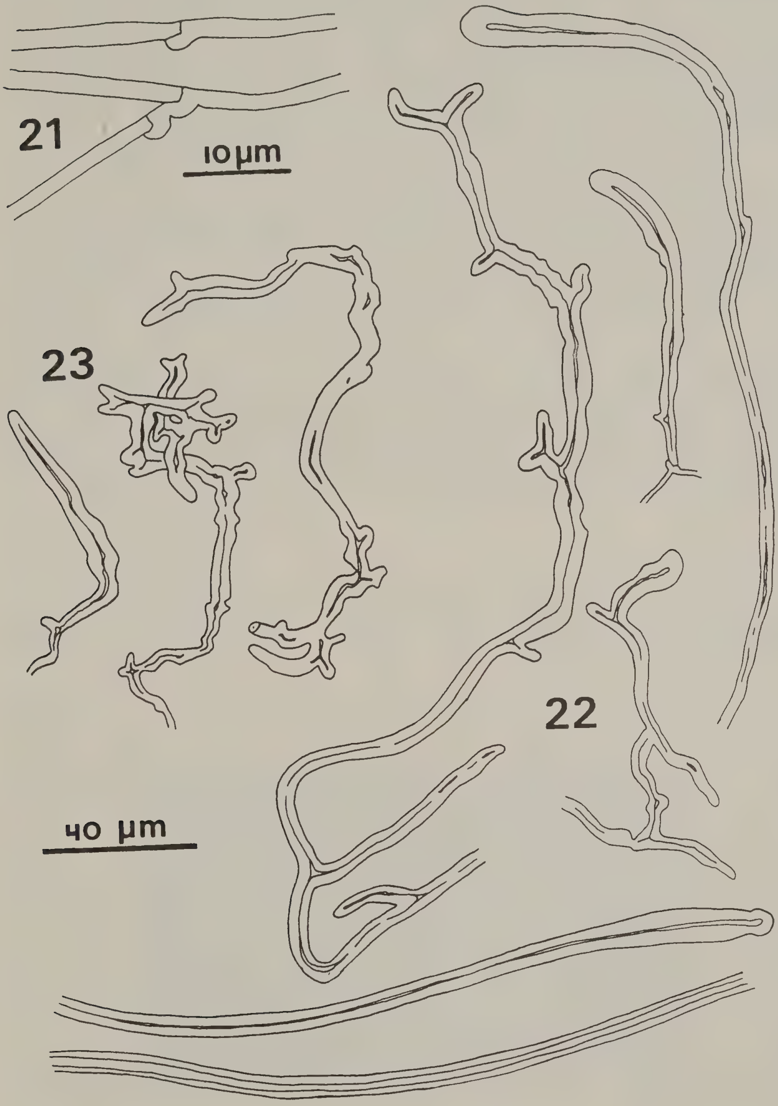


Fig. 20, **Coriolopsis ekunduensis**. Pilear surface (right, from LYAD 1443) and pore surface (left, from LYAD 1072). Bar = 1 cm.

Hyphal system trimitic. Generative hyphae clamped, hyaline, 2-3 µm diam., thin-walled (Fig. 21). Skeletal hyphae 3-7 µm diam., thick-walled, with a distinct lumen or solid; walls hyaline, yellowish or light olivaceous in the context and tubes, dark olivaceous or brown in the upper surface of the pileus; straight or branched with short lateral cylindric to clavate branches (Fig. 22). These branches, together with the terminal apex of the unbranched skeletal hyphae, form the hairs of the pileus and also protrude into the pores. Some of these branches, together with some unbranched skeletal hyphae, may be interpreted as cystidia when protruding into the pores because of their relative short length. In the tube trama the skeletal hyphae are shorter and the branches are more crowded, appearing thus, as binding hyphae (Fig. 23). Nevertheless, their basic structure is the same as that of longer hyphae of the context. Hymenium sterile.

Materials studied: LY AD-1443, Ivory Coast, Banco Forest, leg. G. Gilles nº 32, 15.X.72; LY AD-1449, ibid., leg. A. David, 22.V.72; LY AD-2046 and 2047, Gabon, Makokou, leg. J. Boidin, 5.V.76; LY AD-2066, ibid., leg. ipse D34, 12.V.76, on *Coula edulis*;LY AD-1072, ibid, leg. A.

David, VII.70; Cameroon, leg. Dusen, 1891 (FH, sheet nº 2906 sub *Polyporus ekunduensis*, marked as 'type').



Figs. 21-23, **Coriolopsis ekunduensis** (from LYAD 1072). 21, Generative hyphae. 22, Skeletal hyphae from the context. 23, Skeletal hyphae from the dissepiments.

Remarks: In spite of the sterility of all the studied specimens, this species is distinct within the genus *Coriolopsis* Murr. on account of its macromorphological features, viz. the almost azonate, dark brown pileus and context which contrast with the cream margin and pore surface, and the presence of warts and/or outgrowths on the pilear surface. *Coriolopsis strumosa* (Fr.) Ryv. may also exhibit warts on the pileus but differs in presenting a distinctly zonated and/or sulcated semishining surface, smaller pores 4-6 per mm and a brownish pore surface.

Glabrous pilear surfaces of some specimens of *C. ekunduensis* may appear to have a crust but this is not so, as is shown by microscopical examination.

In the field the specimens were named as '*brown Coriolus*', stressing their dark brown fruitbodies and contexts. This is the main reason for its inclusion in *Coriolopsis* Murr. We are aware, as pointed out by Corner (7), that there seems to exist a gradual change from white-cream coloured contexts to dark brownish ones from one species to another in the *Trametes* - *Coriolopsis* complex. Therefore, the context coloration cannot be used as a reliable taxonomic character unless, as in our case, we want to use it as a practical one to distinguish certain species within the complex. The chemical basis for the different context colours is unknown in these genera, hence the taxonomic value is uncertain.

SKELETOCUTIS DILUTA (Rajchenb.) David & Rajchenb. *stat. nov. et comb. nov.*

Basionym: *Skeletocutis nivea* (Jungh.) Keller var. *diluta* Rajchenb., Mycotaxon 16: 505, 1983.

Fruitbodies annual to biannual, resupinate to effuesed reflexed with poorly to well developed pilei (Fig. 24); resupinate portion up to 8 x 4 cm; pilei semicircular, up to 3 cm long, 1.5 cm radius and 0.8 cm thick. Hymenial surface white cream when fresh, becoming alutaceous (10YR8/4-8/6) upon drying. Pores round, 5-7 per mm. Context very thin or up to 3 mm thick, homogeneous. Tubes up to 2.5 mm long. Pilei pubescent and white cream when; glabrescent, light brown (10YR7/4) or dark brown (7.5YR5/4-4/4) upon drying and in the older portions of the fruitbody.

Hyphal system dimitic but appearing trimitic. Generative hyphae clamped, 2-5 µm diam., with hyaline, thin to irregularly thickened walls, some totally solidified but always with clamps. In the pore mouths with encrusted generative hyphae characteristic of the genus *Skeletocutis* (21). These incrustations are rarely present in the trama and context. The generative hyphae of the context and/or those close to the substrate develop branched arbuscular processes which are solid, 1.5-4 µm diam., congophilic and not metachromatic, resembling binding hyphae but related to generative hyphae. Skeletal hyphae unbranched, 2-5 µm diam., present throughout the fruitbody, with hyaline walls up to 2 µm thick, not congophilic, metachromatic in cresyl-blue, slightly amyloid and dissolving in KOH (28). **Basidia** claviform (6)-8-11 x 3-4 µm. **Spores** allantoid, 3.1-3.5 x 0.5-0.8 µm, hyaline, IKI -, acyanophilous. **Cystidioles** fusiform or mucronate, 7.5-10 x 2-4 µm.

Associated with a white rot in the wood.

Materials studied: BAFC 28250, Argentina, Misiones, Puerto Libertad, Alto Paraná plantation, leg. M. Rajchenberg, III.82, on gymnosperm (holotype); Argentina, Misiones, Iguazú Falls Nat'l Park, leg. L. Ryvarden 31790, on deciduous wood, 1-5.III.82 (BAFC); LY AD-sn, Gabon, Makokou, leg. A. David, VII.70 and LY AD-sn, Batouala.

Cultural features: Previously (27) we described the cultural characters of the polysperm, pointing out the differences found in relation with the cultures of *Skeletocutis nivea* var. *nivea*. From a spore print produced in culture BAFC 2348 (which was used in that study), we determined the sexuality and nuclear behavior of this species.

Spores: uninucleate.

Germination: spores germinate 8-10 days after shedding and grow fast, covering the 9 cm diam. Petri dishes in 2 weeks. In *S. nivea* the spores germinate 15-20 days after dispersion and grow very slowly (10). The hyphal articles are coenocytic, principally the terminal ones. The following are some assays of numbers of nuclei made from the terminal cell backwards:

27-5-2-2-5-2-
12-2-5-2-
22-4-5-2-
19-4-2-2-2-

Sexuality: tetrapolar, eleven single spore cultures were distributed as:

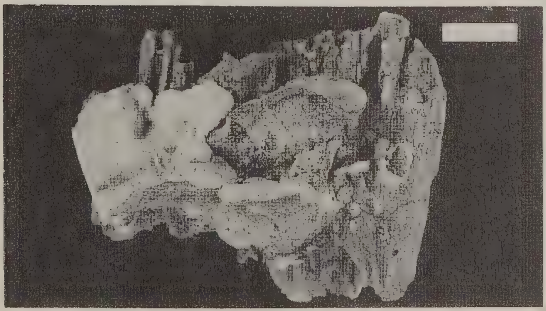


Fig. 24, **Skeletocutis diluta**, fruitbody LYAD sn, Batouala. Bar = 1 cm.

A_1B_1: 1, 2, 11, 16, 18
A_2B_2: 12, 14
A_1B_2: 13, 15, 17
A_2B_1: 19
Polysperm: regularly dikaryotic
Nuclear behavior: heterocytic

Remarks: *Skeletocutis diluta* is distinct within the genus because of the following characters: effused reflexed fruitbodies, small allantoid spores, dimitic hyphal system (generative plus skeletal hyphae) which also includes binding hyphae formed as lateral coralloid processes of the generative hyphae, and skeletal hyphae that dissolve in KOH solution. *Skeletocutis papyracea* David (10), which also has skeletal hyphae that dissolve in KOH solution, differs in having totally resupinate fruitbodies, dimitic hyphal system with scarce development of lateral coralloid processes, larger pores (3-4 per mm) and larger cylindric spores (4.5-5 x 1.5-1.8 µm).

The range is expanded from Argentina to tropical Africa.

FUNALIA TELFARII (Kl.) David & Rajchenb. *comb. nov.*
Basionym: *Polyporus telfarii* Kl., Linnaea 8: 484, 1833.

A morphological description of this species is found in Ryvarden & Johansen (32).

Materials studied: LY AD-1992, Cameroon, Yaoundé, leg. J. David, XI.75; LY AD-1221, Congo, Kinshasa, Katanga, Kipopo, leg. D. Thöen, 10.IX.71; LY AD-1143, ibid., leg. ipse 6.V.71; LY AD-1144, Congo, Kinshasa, Katanga, Luiswishi, leg. ipse, 2.III.71; LY AD-2421, Gabon, Bush Litoral, 13-14 km N of Libreville, leg. G. Gilles, 7.I.78; LY AD-2477, Ivory Coast, along the Comoé River, leg. Mme. Baude, XII.82.

Biological features (from LYAD 1143):
Sexuality: tetrapolar, 16 monosporous cultures were distributed as follows:
A_1B_1: 2, 3, 6, 9
A_2B_2: 8, 10, 12, 14
A_1B_2: 1, 4, 5, 7, 11, 13
A_2B_1: 15, 16
Spores: binucleate.
Germination: very rapid, 1 day after shedding.
Monosporous cultures: the articles are coenocytic, principally the terminal ones. Some assays of numbers of nuclei made from the terminal cell backwards were::
29-6-4-2-2-
28-1-4-2-2-
17-2-2-2-
11-2-2-2-
Polyspermic culture: regularly clamped and dikaryotic
Nuclear behavior: heterocytic.

Remarks: The inclusion of *Polyporus telfarii* in *Funalia* Pat. is supported by its biological -non morphological-features, given above. The same characters are present in *F. fulvocinerea* (Murr.) David & Rajchenb., *F. hispida* and *F. trogii* (8, 9). *Funalia leonina* Pat., type species of the genus, has not been studied yet in all these respects but De (14) has recently established that it has a tetrapolar sexuality and binucleated spores. Though trametoid in morphology, *Funalia* differs in its binucleate spores and heterocytic nuclear behavior in contrast with *Trametes* Fr. which has uninucleate spores and a normal nuclear behavior.

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FUNGI OF THE KERMADEC ISLANDS

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Abstract

A short historical account is given of fungal collections from the Kermadec Islands, New Zealand, followed by an annotated list of the fungi, and an alphabetical host list. Most of the records are based on collections made by the author in September 1988, when particular attention was given to fungi causing plant diseases, although conspicuous macrofungi and some leaf litter samples were also collected. The list contains 89 named species of fungi and 10 Myxomycetes. Among the specimens are, perhaps, 12 undescribed species. Several fungi found in the Kermadec Islands have, in general, a tropical or subtropical distribution; others have a restricted distribution in mainland New Zealand, being confined to northern parts of the North Island; some occur throughout New Zealand; and several are recorded in New Zealand for the first time, together with some new host/pathogen records.

Keywords Kermadec Islands; New Zealand; fungi; distributions; new records; host plants

The Kermadec Islands (29-31.5° S, 178-179° W) consists of Raoul (Sunday) Island together with the 8 small Herald Islets, and the Southern Islands of Macauley, Curtis and Cheeseman, and L'Esperance (French Rock). Raoul Island is 976 km north-east of Cape Brett, the closest point of the North Island, New Zealand, while L'Esperance, the southern most island, is 250 km from Raoul (Fig. 1). The total land area is approximately 3,385 ha with Raoul Island the largest at 2,943 ha, followed by Macauley at 324 ha. The Kermadec Islands are volcanic in origin, with present day activity on Raoul and Curtis. Mean annual daily temperatures on Raoul Island range from 16-22° C. Rainfall is 1,500 mm near sea-level but increases on higher ground.

Europeans discovered the islands in the late 18th Century, and Raoul and the Kermadecs were named by Admiral D'Entrecasteaux. There was, however, an earlier Polynesian presence, perhaps from the 14th Century. Periodic European settlement took place from 1836 to early this century, but today the islands are inhabited by only 3 or 4 meteorological and conservation staff.

Accounts of the vegetation were provided by Oliver (1909) and Sykes

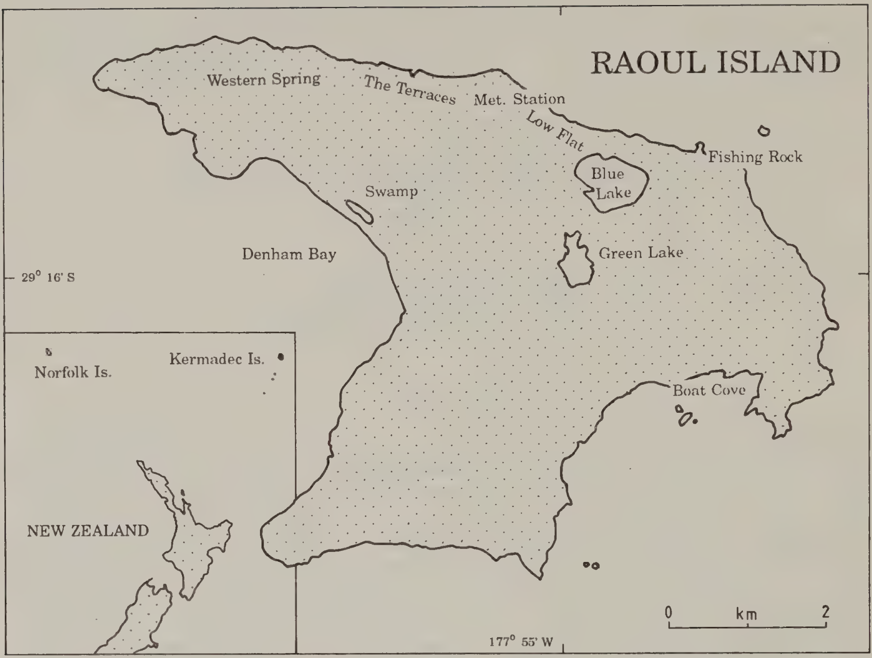
RAOUL ISLAND
Western Spring
The Terraces
Met. Station
Low Flat
Fishing Rock
Blue Lake
Swamp
Green Lake
Denham Bay
29° 16' S
Boat Cove
Norfolk Is.
Kermadec Is.
NEW ZEALAND
0 km 2
177° 55' W

Figure 1. Location of Kermadec Islands, and main collecting sites.

(1977). For Raoul Island there is a coastal and an inland plant community. The coastal vegetation consists of an open community of grasses, sedges and small herbs and a denser, closed community. The inland vegetation is either dry forest, below about 250 m, or wet forest above. *Metrosideros kermadecensis* dominates both types, but there are differences in the understorey. A specialised form of wet forest consists of a pure stand of the palm, *Rhopalostylis baueri* var. *cheesemanii*. Adventive vegetation, mainly temperate species from Europe, dominates large areas of Raoul Island. Some plants, such as *Aleurites moluccana* and *Cordyline fruticosa* were probably pre-European introductions. There are several relics of cultivated vegetation e.g., citrus, elephant's ear (*Alocasia brisbanensis*), taro (*Colocasia esculenta*), tomato. According to Sykes (1977) the vascular plant flora consists of 113 indigenous taxa including 23 endemic taxa, 152 adventive taxa and 30 which are persistent relics of cultivation.

Few fungi are known from the Kermadec Islands. The first botanical collections in the Kermadecs, made in 1854 by W. Milne and J. MacGillivray during the voyage of H.M.S Herald, included some fungi. Milne (1855) in a letter to Hooker mentioned that he gathered many 'Lichens' and 'Hypha' (presumably fungi) on the summit of Sunday Island (now Raoul Island). Cunningham (1950, 1965) listed 3 polypores (*Daedalea aspera* = *Lenzites vespacea*, *Lenzites tenuis* = *L. acuta*, and *Polyporus rhipidium* = *Panellus* *pusillus*) held at Kew, which were collected on Raoul Island during the Herald voyage, as well as 3 other species collected by Oliver. W.R.B. Oliver, an Australian-born naturalist, and later Director of the Dominion Museum, spent 10 months on Raoul Island in 1908. A small number of fungi were collected and sent to G. Massee at Kew for identification. As a result, Oliver (1911) published a list of 10 fungi and 2 Myxomycetes. Two of these fungi had been also collected by Milne and MacGillivray. Seven of Oliver's collections were retained as duplicates in the Dominion (now National) Museum in Wellington, and these are now housed in Herb. PDD.

There appear to be only four other mentions of fungi from the Kermadec Islands. Cunningham (1950) listed *Coriolus blumei* (= *Trametes menziesii*) as occurring in the Kermadec Islands. However, this record was not carried forward by Cunningham (1965) and may be an error. Morton (1957) gave an account of the collecting of the wood ear fungus, *Auricularia polytricha*, for export, and Sykes (1977) mentioned the same fungus. McKenzie (1981) recorded the rust, *Puccinia microspora*, from botanical samples of the host, *Imperata cheesemanii*, in Herb. CHR.

Prior to the author visiting Raoul Island there were 5 specimens of polypore bracket fungi, and a specimen of *Schizophyllum commune*, in Herb. PDD collected by W.R. Sykes and J.C. Watt in 1966-67. In addition, there was a specimen of *Diaporthe citri* ex Herb. LEV, intercepted at Gisborne on citrus from Raoul Island.

All fungi known from the Kermadec Islands have come from Raoul Island; there are no collections from the Southern Islands. Several fungi found in the Kermadec Islands have, in general, a tropical or subtropical distribution. In some cases they are pathogens associated with tropical hosts e.g., *Cercospora ipomoeae* on *Ipomoea pes-caprae* ssp. *brasiliensis, Mycosphaerella aleuritis* on *Aleurites moluccana, Puccinia levis* var. *panici-sanguinalis* on *Digitaria ciliaris*, and *Uromyces bidenticola* on *Bidens pilosa*. Others, such as *Ellisiopsis gallesiae* and *Periconia echinochloae* are saprophytes normally found in tropical regions. Some of the fungi have a restricted distribution in mainland New Zealand, being confined to northern parts of the North Island. These include pathogens which reflect host distribution, such as *Ascochyta paspali* on *Paspalum dilatatum, Graphiola phoenicis* on *Phoenix* spp., *Puccinia cynodontis* on *Cynodon dactylon, P. paspalina* on *Paspalum orbiculare*, and *Uromyces tenuicutis* on *Sporobolus africanus*, or saprophytes such as *Hymenochaete villosa, Lenzites vespacea, Panellus pusillus*, and *Tyromyces citreus*. Many other species occur throughout New Zealand. Among the specimens are, perhaps, 12 undescribed species.

The author visited Raoul Island from 16-23 September 1988. While particular attention was given to diseased plants, conspicuous macrofungi and leaf litter samples were also collected. Specimens were dried and taken to Auckland for examination. All identified specimens are housed in the herbarium of DSIR Plant Protection (PDD). Cultures were made of *Bipolaris* and of *Cochliobolus* anamorphs from grasses; these have been deposited in the International Collection of Micro-organisms from Plants (ICMP), Auckland.

The following list contains 89 named species of fungi and 10 Myxomycetes. Several fungi are recorded in New Zealand for the first time, and together with several new host/pathogen records for New Zealand are indicated by an asterisk (*). All specimens have been collected by the author unless otherwise stated. The group to which each fungus belongs is denoted by a letter after the author citation thus: A = Ascomycotina, B = Basidiomycotina, D = Deuteromycotina. For the rust fungi, II indicates the presence of uredinia and III telia.

FUNGI

Acroconidiella tropaeli (Bond) Lindquist & Alippi, *Darwiniana 13*: 613, 1964 (D)
on *Tropaeolum majus* L. (PDD 54621).
Leaf spot. Common in the North Island.

*****Acrodontium crateriforme*** (van Beyma) de Hoog, *Stud. Mycol. 1*: 26, 1972 (D)
on *Meliolina sydowiana* on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 54807).
Overgrowing and probably parasitic on *Meliolina*. In New Zealand known only from Raoul Island; also known from Europe and Indonesia.

Ampelomyces quisqualis Cesati ex Schlechtendal, *Bot. Zeitung 10*: 301, 1852 (D)
on *Oidium* sp. on *Veronica persica* (PDD 54630, 54746).
Hyperparasitic on Erysiphales. Worldwide in distribution, it is common in the Auckland area.

Antrodiella sp. (B)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 59469).

Apiospora montagnei Saccardo, *Nuovo Giorn. Bot. Ital. 7*: 306, 1875 (A)
on *Phyllostachys* sp. (PDD 54747).
Saprophytic on dead culms. Widespread in the North Island, especially on bamboos.

Armillaria ?novae-zelandiae (Stevenson) Herink in Hasek, *Sympozium o Václavce Obecné* Armillaria mellea: 43, 1973 (B)
*on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 54731).
Mushroom. This indigenous pathogenic species is widespread in New Zealand on many woody hosts.

Ascochyta paspali (H. Sydow) Punithalingam, *Mycol. Pap. 142*: 125, 1979 (D)
on *Paspalum dilatatum* Poir. (PDD 54615).
Leaf spot. Lesions often extending the length of the blade and sometimes into the sheath. Common in northern half of the North Island.

Auricularia polytricha (Montagne) Saccardo, *Atti del Reale Istituto veneto di scienze, lettere ed arti. Ser. 6, 3*: 722, 1885 (B)
on *Corynocarpus laevigata* (Oliver 1911 - on dead trunks).
on *Metrosideros kermadecensis* (PDD 55046).
on *Ricinus communis* (Sykes 1977 - as *Auricularia* sp.).

on fallen logs and on castor-oil trees (Morton 1957 - as Jew's Ear).
Wood ear fungus. Widespread and common throughout New Zealand on dead wood of many different plants. Morton (1957) gave an account of the Bell's children gathering this fungus by the sackful before shipping it to mainland New Zealand and San Francisco. The Bell family spent 35 years on Raoul Island from 1878. The fungus was described as growing in 'unlimited quantities on almost every fallen log, but particularly thickly on decayed castor-oil trees.'

Bipolaris brizae (Nisikado) Shoemaker, *Canad. J. Bot. 37*: 882, 1928 (D)
on *Briza minor* L. (PDD 54774; ICMP 9938).
Leaf spots oval or elliptical 12 x 4 mm, coalescing to cover large areas of the leaf, sometimes forming as streaks which may extend the length of the blade, tan coloured, often with a distinct purple border. The fungus is also recorded for the first time in New Zealand on *B. maxima* L. On this host it produces an eye spot up to 5 x 2 mm but often much smaller, pale centre with purple or almost black border. This fungus is known from South Africa, Japan and Australia on *Briza* spp. and on *Gastridium ventricosum* (Gouan) Schinz & Thell.

Additional specimens examined on *Briza minor*:
Northland, Kaitaia, 30.XI.1976, E.H.C. McKenzie (PDD 35670); Kaikohe, 2.XII.1976, E.H.C. McKenzie (PDD 35668); Dargaville, 21.XI.1978, E.H.C. McKenzie (PDD 38768). Auckland, Whangaparoa, 20.X.1962, G.C.M. Latch (PDD 34486); Waitakere Ranges, 16.XI.1975, E.H.C. McKenzie (PDD 34852); Waikumete, 9.XI.1976, E.H.C. McKenzie, W.S.M. Versluys, S. Bowman (PDD 35533); Mt Albert, 30.X.1976, E.H.C. McKenzie (PDD 35481).
Specimens examined on *Briza maxima*:
Northland, Ahipara, 20.IX.1977, E.H.C. McKenzie (PDD 37317). Auckland, Bethells Beach, 21.XI.1976, E.H.C. McKenzie (PDD 36570); Laingholm, 25.XI.1979, E.H.C. McKenzie (PDD 40168); Devonport, 16.IV.1990, E.H.C. McKenzie, J.M. McKenzie (PDD 57321); Sandringham, 14.XI.1988, R.E. Beever (PDD 54905); Ellerslie, 12.XI.1976, W.S.M. Versluys (PDD 35536). Bay of Plenty, Whakatane, 17.XI.1964, G.C.M. Latch (PDD 34487).

Bipolaris sp. (D)
*on *Bromus willdenowii* Kunth (PDD 54741).
*on *Poa anceps* Forst. f. ssp. *polyphylla* (Hack.) Edgar (PDD 54742; ICMP 9931, 9933, 10095, 10096, 10097, 10098, 10099).
On senescing leaves.

Botrytis cinerea Persoon, *Tent. Disp. Meth. Fung.*: 47, 1797 (D)
on *Hibiscus rosa-sinensis* L. (PDD 54601).
Flower blight. Very common throughout New Zealand on a wide range of host plants, causing damping-off, dieback, flower and fruit rots.

Cercospora ipomoeae Winter, *Hedwigia 26*: 34, 1887 (D)
on *Ipomoea pes-caprae* (L.) R. Br. ssp. *brasiliensis* (L.) van Ooststr. (PDD 54635).
Leaf spots circular up to 5 mm diam., grey with dark brown or black border. Centre of spot sometimes falls out. The fungus is circumglobal in the tropics, reflecting the widespread distribution of beach morning-glory.

Cercospora microlaenae McKenzie & Latch, *N.Z. J. Agric. Res. 27*: 115, 1984 (D)
on *Microlaena stipoides* (Labill.) R. Br. (PDD 54604).
Leaf spot. Common on this grass in the Auckland area.

Cercospora zebrina Passerini, *Hedwigia 16*: 124, 1877 (D)
*on *Trifolium dubium* Sib. (PDD 54638).
Leaf spot. Common throughout New Zealand on spotted medick and clovers.

Cercospora spp. (D)
*on *Cordyline fruticosa* (L.) Chév. (PDD 54671, 54805).
*on *Cyperus brevifolius* (Rottb.) Hassk. (PDD 54743, 54744, 54806).
On *Cordyline* associated with a leaf blotch, often rectangular and vein-limited, pale brown or reddish. On *Cyperus* oval or rectangular leaf spots, often limited by mid-rib, reddish-brown or black.

Cercosporidium graminis (Fuckel) Deighton, *Mycol. Pap. 112*: 62, 1967 (D)
on *Dactylis glomerata* L. (PDD 54603).
Leaf streak. Common throughout New Zealand on many different grasses.

Chloridium sp. (D)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 59366).
Saprophytic on fallen leaves.

Circinotrichum papakurae Hughes & Pirozynski, *N.Z. J. Bot. 9*: 40, 1971 (D)
on *Melicytus ramiflorus* J.R. & G. Forst. ssp. *ramiflorus* (PDD 54748).
Saprophytic on fallen leaves. Described from New Zealand on fallen leaves of *Beilschmiedia tarairi* (A. Cunn.) Benth. & Hook. f.

Circinotrichum sp. (D)
on *Melicytus ramiflorus* J.R. & G. Forst. ssp. *ramiflorus* (PDD 59369, 59370).
Saprophytic on fallen leaves.

Clathrus cibarius (Tulasne) Fischer (Oliver 1911) = *Ileodictyon cibarius*

Clavaria sp. (B)
on *Melicytus ramiflorus* J.R. & G. Forst. ssp. *ramiflorus* (PDD 59470).

Coccomyces limitatus (Berkeley & Curtis) Saccardo, *Syll. Fung. 8*: 747, 1889 (A)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 54665).
Common throughout New Zealand on fallen leaves, especially *Knightia excelsa* R. Br. and *Pseudopanax* spp.

Cochliobolus cynodontis Nelson, *Mycologia 56*: 67, 1964 (A)
anamorph *Bipolaris cynodontis* (Marignoni) Shoemaker, *Canad. J. Bot. 37*: 883, 1959
*on *Digitaria* sp. (PDD 59371; ICMP 10100).
*on *Paspalum conjugatum* Berg. (PDD 54797, 54818; ICMP 9927, 9929, 9930, 9934, 9936, 9939).
On *Digitaria* associated with dead leaves. On *Paspalum* associated with leaf spot, senescing and dead leaves. Spots oval or elliptical up to 5 x 2 mm, tan coloured with a brown border. Previously recorded in New Zealand on seed of barley and of various grasses.

Cochliobolus intermedius Nelson, *Mycologia 52*: 776, 1961 (A)
anamorph *Curvularia intermedia* Boedijn, *Bull. Jard. bot. Buitenzorg. Ser. 3, 13*: 126, 1933
on *Digitaria* sp. (PDD 54924, 59380; ICMP 9935, 9937).
On dead flower head. Circumglobal in tropics on many different grasses.

Cochliobolus ravenelii Alcorn, *Mycotaxon 13*: 341, 1981 (A)
anamorph *Bipolaris ravenelii* (Curtis) Shoemaker, *Canad. J. Bot. 37*: 884, 1959
on *Sporobolus africanus* (Poir.) Robyns & Tournay (PDD 54816; ICMP 10101).
Black mould on inflorescence of *Sporobolus* spp. Common and widespread in the North Island.

Cochliobolus sativus (Ito & Kuribayashi) Drechslera ex Dastur, *Indian J. Agric. Sci. 12*: 733, 1942 (A)
anamorph *Bipolaris sorokiniana* (Saccardo) Shoemaker, *Canad. J. Bot. 37*: 884, 1959
*on *Bromus willdenowii* Kunth (PDD 55639; ICMP 9928, 9932, 10104).
Leaf spots oval or elliptical up to 5 x 1 mm, grey with a dark brown or black border. Common in New Zealand on seed of cereals.

Additional specimen examined on *Bromus willdenowii*:
Coromandel, Little Barrier Island, 6.IV.1988, E.H.C. McKenzie (PDD 48-847).

Colletotrichum ?falcatum Went, *Arch. Java Suikerindustrie 1*: 265, 1893 (D)
on *Imperata cheesemanii* Hack. (PDD 54960).
On senescing leaves.

Colletotrichum graminicola (Ces.) Wilson, *Phytopathology 4*: 110, 1914 (D)
on *Poa annua* L. (PDD 54617, 54637).
*on *Polypogon monspeliensis* (L.) Desf. (PDD 54749).
Associated with senescing plant parts and with leaf streaks. Widespread and common in New Zealand on many different grasses.

Colletotrichum spp. (D)
*on *Alocasia brisbanensis* (F.M. Bailey) Domin (PDD 54944).
*on *Coprosma petiolata* Hook. f. (PDD 54947).
On *Alocasia* associated with oval leaf spots up to 2 cm long, pale brown, centre of spot often rotting and falling away. On *Coprosma* circular or irregular leaf spots up to 1 cm diam., cream coloured with a distinct brown or reddish-brown border; acervuli very noticeable on upper surface of leaf.

Conoplea sp. (D)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 59372).
Saprophytic on fallen leaves.

Coriolus blumei (Léveillé) G.H. Cunningham (Cunningham 1950) = *Trametes menziesii*

Crepidotus spp. (B)
on *Rhopalostylis baueri* (Hook. f.) Wendl. & Druce var. *cheesemanii* Sykes (PDD 54738).
on dead wood (PDD 54736).

Cryptophiale sp. (D)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 59365).
Saprophytic on fallen leaves.

Cyclomyces tabacinus (Montagne) Patouillard, *Essai Tax. Hyménomyc.*: 98, 1900 (B)
(Oliver 1911 - as *Polystichus* [sic] *tabacinus*); (Cunningham 1965 - as *Inonotus tabacinus* - in Kew under *Polystictus tabacinus* 'Sunday Island, Kermadecs').
Polypore bracket fungus. Saprophytic on dead wood. Occurs throughout New Zealand, but is not common.

****Dactylaria ?junci*** M.B. Ellis, *More Dematiaceous Hyphomycetes*: 172, 1976 (D)
on *Cyperus brevifolius* (Rottb.) Haask. (PDD 54798).
Associated with brown spotting on old leaves. Originally described on *Juncus effusus* L. in Ireland, a similar fungus has been found on *Carex* spp. and *Uncinia* spp. in the North Island.

Daedalea aspera Klotzsch (Cunningham 1965) = *Lenzites vespacea*

Daedalea subsulcata Berkeley & Broome (Oliver 1911) = *Lenzites vespacea*

Daedalea tenuis Berkeley (Cunningham 1965) = *Lenzites acuta*

Daldinia concentrica (Bolton) Cesati & de Notaris, *Comm. Soc. Crittogam. Ital. Milan 1*: 197, 1863 (A)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 54733).
Cramp balls. Usually saprophytic but may occur as a wound pathogen on a wide range of host plants. Widespread throughout New Zealand.

Diaporthe citri Wolfe, *J. Agric. Res. 33*: 625, 1926 (A)
anamorph *Phomopsis citri* Fawcett, *Phytopathology 2*: 109, 1912
on *Citrus* sp. (PDD 56425 ex LEV - intercepted at Gisborne on citrus from Raoul Island, 15 Nov 1965).
Melanose on fruit, leaves and young shoots. Common on citrus in Auckland and Northland.

Dictyochaeta sp. (D)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 59377).
Saprophytic on fallen leaves.

Dictyopanus rhipidium (Berkeley) Patouillard (Cunningham 1965) = *Panellus pusillus*

****Ellisiopsis gallesiae*** Batista & Nascimento, *Anais Soc. Biol. Pernambuco. 14*: 21, 1956 (D)
on *Melicytus ramiflorus* J.R. & G. Forst. ssp. *ramiflorus* (PDD 54613, 54647).
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 54648).
on leaf litter (PDD 54633).
Saprophytic on fallen leaves. Widespread in tropical areas, this species was previously unknown in New Zealand.

Erysiphe cichoracearum de Candolle, *Fl. Franç. 2*: 274, 1805 (A)
on *Aster subulatus* Mich. (PDD 54750).
on *Veronica persica* Poir. (PDD 54631, 54753).

Powdery mildew. Common and widespread in New Zealand on many introduced plants especially Asteraceae and Cucurbitaceae.

Eudarluca caricis (Fries) O. Eriksson, *Bot. Not. 119*: 35, 1966 (A)
anamorph *Sphaerellopsis filum* (de Bivona-Bernardi) Sutton, *Mycol. Pap. 141*: 196, 1977
*on *Puccinia flaccida* on *Oplismenus imbecillus* (R. Br.) Roem. & Schult. (PDD 54623).
*on *Puccinia microspora* on *Imperata cheesemanii* Hack. (PDD 54751).
*on *Puccinia paspalina* on *Paspalum orbiculare* Forst. f. (PDD 54752).
*on *Tranzschelia discolor* on *Prunus persica* (L.) Batsch. (PDD 54624).
Hyperparasitic in sori of rust fungi. Common and widespread in New Zealand on many different species of rust fungi.

Favolus rhipidium (Berkeley) Cooke (Oliver 1911) = *Panellus pusillus*

Fomes applanatus (Persoon) Gillet (Oliver 1911) = *Ganoderma applanatum*

Fomes zealandicus Cooke (Oliver 1911, Cunningham 1950) = *Phellinus wahlbergii*

Fulvia fulva (Cooke) Ciferri, *Atti Ist. Bot. Univ. Lab. Crittogam. Pavia Ser. 5, 10*: 246, 1954 (D)
on *Lycopersicon esculentum* Mill. (PDD 54642).
Leaf mould. Common in glasshouse tomato crops in New Zealand.

Ganoderma applanatum (Persoon) Patouillard, *Bull. Soc. Mycol. Fr. 5*: 67, 1889 (B)
*on *Metrosideros kermadecensis* W.R.B. Oliver - Raoul Island, 4 Jan 1967, J.C. Watt (PDD 26141); (PDD 59463, 59464).
*on *Myrsine kermadecensis* Cheesem. - Raoul Island, 14 Jan 1967, J.C. Watt (PDD 26139).
Raoul Island, Oct. 1908, W.R.B. Oliver (PDD 17283, 39247); (Oliver 1911 - as *Fomes applanatus*).
Polypore bracket fungus. Associated with a white heart rot of living trees. Large fruitbodies, up to 16 cm diam. and 6 cm thick, occur on dead standing and fallen trunks. Widespread and common in New Zealand on many woody hosts. The identity of this fungus is in doubt; *G. applanatum* is probably confined to the northern temperate zone.

***_Geastrum ?fimbriatum_** (Fries) Fischer, *Natür. Pflanzenf. 7a*: 73, 1933 (B)
on ground (PDD 54735).
Earth star. This species has not been previously recorded from New Zealand. Found in North America, Europe, Africa and Australia.

Glomerella cingulata (Stoneman) Spaulding & Schrenk, *Science, Ser. 2, 17*: 751, 1903 (A)
anamorph *Colletotrichum gloeosporioides* (Penzig) Penzig & Saccardo, *Atti Ist. veneto Sci., Ser. 6, 2*: 670, 1884
*on *Hibiscus tiliaceus* L. (PDD 54953).
on *Passiflora edulis* Sims (PDD 54952).
On *Hibiscus* leaf spots irregular up to 2 cm wide, brown with a black border on upper surface of leaf; grey with no distinct border on lower surface of leaf. On *Passiflora* associated with damaged areas of leaf.

Graphiola phoenicis (Mougeot) Poiteau, *Ann. Sci. Nat. 3*: 473, 1824 (B)
on *Phoenix dactylifera* L. (PDD 54607).

False leaf smut. Small, grey or black, erumpent pustules mainly on lower surface of leaf. Occurs on *Phoenix canariensis* Hort. ex Chabaud in Auckland, and recorded once on date palm in Northland.

Gyrothrix sp. (D)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 59367).
on *Rhopalostylis baueri* (Hook. f.) Wendl. & Druce var. *cheesemanii* Sykes (PDD 59368).

Saprophytic on dead wood of *Metrosideros* and on fallen leaves of *Rhopalostylis*.

Hymenochaete villosa (Leveille) Bresadola, *Ann Mycol. 8*: 588, 1910 (B)
on dead wood - Raoul Island, Jan 1967, W.R. Sykes (PDD 26105).

Bracket fungus. On dead wood, associated with a pocket rot. In mainland New Zealand known only in Northland and Auckland.

Hymenoscyphus sp. (A)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 54668).

Saprophytic on fallen leaves.

Hypocrea sp. (A)
on *Rhopalostylis baueri* (Hook. f.) Wendl. & Druce var. *cheesemanii* Sykes (PDD 54662).

Saprophytic on fallen leaves.

Ileodictyon cibarius L.R. & C. Tulasne, *Ann, Sci. Nat. Ser. 3, 2*: 114, 1844 (B)
(Oliver 1911 - as *Clathrus cibarius* - on ground in forest).

Basket fungus. Common and widespread in the North Island.

Inonotus tabacinus (Montagne) P. Karsten (Cunningham 1965) = *Cyclomyces tabacinus*

Lachnella sulphurea (Saccardo & Ellis) G.H. Cunningham, *Bull. N.Z. Dep. Scient. Ind. Res. 145*: 311, 1963 (B)
on *Rhopalostylis baueri* (Hook. f.) Wendl. & Druce var. *cheesemanii* Sykes (PDD 59466).

Cupulate Hymenomycete. Fruit bodies crowded on dead plant material. Common and widespread in the North Island.

Lachnella sp. (B)
on *Rhopalostylis baueri* (Hook. f.) Wendl. & Druce var. *cheesemanii* Sykes (PDD 59467, 59468).

Lenzites acuta Berkeley, *London J. Bot. 1*: 146, 1842 (B)
(Cunningham 1950 - as *Lenzites tenuis* - in Kew under *Daedalea aulacophylla* - 'Raoul Island, Kermadecs, H.M. Herald'); (Cunningham 1965 - as *Daedalea tenuis*).

Polypore bracket fungus. On dead wood. In New Zealand known only from Raoul Island.

Lenzites aspera (Klotzsch) Fries (Cunningham 1950) = *Lenzites vespacea*

Lenzites tenuis (Berkeley) G.H. Cunningham (Cunningham 1950) = *Lenzites acuta*

Lenzites vespacea (Persoon) Ryvarden, *Norw. J. Bot. 19*: 232, 1972 (B)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 55048).
Raoul Island, 8.V.08, W.R.B. Oliver (PDD 17296, 39248); (Oliver 1911 - as *Daedalia* [sic] *subsulcata*); (Cunningham 1950 - as *Lenzites aspera* - in Kew under *Daedalea subsulcata* - 'Sunday Island, Kermadecs, W.R.B. Oliver'); (Cunningham 1965 - as *Daedalea aspera* - in Kew under *Daedalea tenuis* - 'Kermadec Islands, voyage of H.M.S. Herald', and under *D. subsulcata* - 'Sunday Island, W.R.B. Oliver').
Polypore bracket fungus. On dead wood. In mainland New Zealand known only in Northland.

******Leptotrichila cerastiorum*** (Wallroth) Schuepp, *Phytopathol. Z. 36*: 261, 1959 (A)
on *Cerastium glomeratum* Thuillier (PDD 54632).
Orange coloured ascocarps present on both surfaces of living leaves. Apart from general yellowing of older leaves, there is no obvious discolouration associated with individual ascocarps. Fungus previously known in North America and Europe.

Lophodermium gramineum (Fries) Chevallier, *Fl. Gén. Env. Paris 1*: 435, 1826 (A)
on *Poa anceps* Forst. f. ssp. *polyphylla* (Hack.) Edgar (PDD 54652).
Saprophytic on fallen leaves. Widespread and common throughout New Zealand on both indigenous and introduced grasses.

Magnaporthe grisea (Hebert) Barr, *Mycologia 69*: 954, 1977 (A)
anamorph *Pyricularia grisea* Saccardo, *Michelia 2*: 20, 1880
*on *Stenotaphrum secundatum* (Walt.) Ktze (PDD 54616).
Eye spot. Common on *Digitaria sanguinalis* (L.) Scop. in the northern half of the North Island. It has been also found on *S. secundatum* in Auckland and Northland.

Additional specimens examined on *Stenotaphrum secundatum*:
Northland, Kaikohe, 3.V.1976, E.H.C. McKenzie (PDD 34804); Omanaia, 5.V.1976, E.H.C. McKenzie (PDD 34813); Waitangi, 19.II.1972, J.M. Dingley (PDD 29744); Waitangi, 22.IX.1977, E.H.C. McKenzie (PDD 37237). Auckland, Muriwai, 11.V.1969, J.M. Dingley (PDD 26737); Parau, 13.V.1971, J.M. Dingley (PDD 29238).

Melampsora euphorbiae (Schubert) Castagne, *Observ. Ured. 2*: 18, 1843 (B)
on *Euphorbia peplus* L. (PDD 54606 - II, III).
Rust. Common and widespread in New Zealand.

******Meliolina sydowiana*** Stevens, *Bern. P. Bishop Mus. 19*: 46, 1925 (A)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 54799).
Sooty blotch on lower surface of leaves. Recorded from Hawaii and Cook Islands on *Metrosideros* spp.

Microsphaera trifolii (Greville) U. Braun, *Nova Hedwigia 34*: 685, 1981 (A)
on *Trifolium dubium* Sib. (PDD 54639).
Powdery mildew of clovers. In New Zealand it infects several *Trifolium* spp. and some other legumes.

******Mycosphaerella aleuritis*** Ou, *Sinensia 11*: 175, 1940 (A)
anamorph *Pseudocercospora aleuritis* (Miyake) Deighton, *Mycol. Pap. 140*:

138, 1976
on *Aleurites moluccana* (L.) Willd. (PDD 54619, 54634).
Leaf spots angular up to 3 mm wide, dark brown. Circumglobal in tropics and subtropics.

Mycosphaerella killianii Petrak, *Ann. Mycol. 39*: 324, 1941 (A)
on *Trifolium repens* (PDD 54611, 54622).
Black or sooty mould of clovers. Black fungal colonies on lower surface of leaves. Common and widespread in New Zealand.

Nectria sp. (A)
on *Rhopalostylis baueri* (Hook. f.) Wendl. & Druce var. *cheesemanii* Sykes (PDD 54732).
On base of fallen leaves.

Olidodendron sp. (D)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 59373).
Saprophytic on fallen leaves.

Panellus pusillus (Persoon ex Léveillé) Burdsall & Miller, *Beih. Nova Hedwigia 51*: 85, 1975 (B)
on ?*Metrosideros kermadecensis* W.R.B. Oliver (PDD 55029, 55045).
Raoul Island, June 1908, W.R.B. Oliver (PDD 17288, 39249); (Oliver 1911 - as *Favolus rhipidium*); (Cunningham 1950 - as *Polyporus rhipidium* - in Kew under *Favolus rhipidium* - 'Sunday Island, Kermadecs, W.R.B. Oliver', 'Raoul Island, Kermadecs, McGilivray, voyage of H.M.S. Herald'); (Cunningham 1965 - as *Dictyopanus rhipidium* - in Kew under *Favolus rhipidium* - 'Sunday Island, Kermadecs', 'Raoul Island, Kermadecs').
Polypore bracket fungus. On dead wood, associated with a white rot. In mainland New Zealand known only in Northland.

Periconia echinochloae* (Batista) M.B. Ellis, *Dematiaceous Hyphomycetes*: 347, 1971 (D)
on *Paspalum conjugatum* Berg. (PDD 54826).
Saprophytic on dead leaves. In New Zealand known only from Raoul Island, but is circumglobal in the tropics, especially on grasses.

Phellinus senex (Nees & Montagne) Imazeki, *Bull. Govern. Forest Exp. Sta. 57*: 115, 1952 (B)
on *Metrosideros kermadecensis* W.R.B. Oliver - Raoul Island, 17 Nov 1966, J.C. Watt (PDD 26137); Dec 1966, W.R. Sykes (PDD 26138).
Polypore bracket fungus. On dead wood, associated with a white pocket rot. Common and widespread on many different plants in New Zealand.

Phellinus wahlbergii (Fries) Reid, *Contr. Bolus Herb. 7*: 97, 1975 (B)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 59465).
Raoul Island, May 1908, W.R.B. Oliver (PDD 17295). (Oliver 1911 - as *Fomes zealandicus*); (Cunningham 1950 - as *Fomes zealandicus* - 'Sunday Island, Kermadecs, W.R.B. Oliver'); (Cunningham 1965 - as *Phellinus zealandicus* - in Kew under *Fomes zealandicus* - 'Sunday Island, Kermadec Islands, W.R.B. Oliver').
Polypore bracket fungus. Associated with a white pocket rot. Widespread and common in New Zealand on dead wood.

Phellinus zealandicus (Cooke) G.H. Cunningham (Cunningham 1965) = *Phellinus wahlbergii*

Phyllachora cyperi Rehm in Thumen, *Rev. Sci. e Litt. Inst. Coimbra 27*: 29-30, 1879 (A)
on *Cyperus ustulatus* A. Rich. (PDD 54754).
Tar spot. Elliptical lesions up to 2 cm long x 0.5 cm wide, black. Common on *C. ustulatus* in Northland and Auckland; also known from North America, West Indies, and Europe.

Additional specimens examined:
Northland, Opito Bay, 26.VI.1973, J.M. Dingley (PDD 30908). Auckland, Waiwera, 10.VIII.1968, J. M. Dingley (PDD 26320); Piha, 5.IX.1960, J.M. Dingley (PDD 32685). Coromandel, Little Barrier Island, 31.VIII.1958, J.M. Dingley (PDD 18481); Little Barrier Island, 5.IV.1988, E.H.C. McKenzie (PDD 48859).

Phyllosticta sp. (D)
*on *Cordyline fruticosa* (L.) Chév. (PDD 54808).
Leaf spots circular to irregular up to 4 mm diam., reddish-brown.

Plectania platensis (Spegazzini) Rifai, *Verh. Konink. Ned. Akad. Wetensch. Natuurk. 47(3)*: 29, 1968 (A)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 54737).
Cup fungus. Apothecia black, 25 mm diam., on dead wood. The fungus has been recorded from South America, Europe, Africa and Australia, but always on *Eucalyptus* spp.

Pleurotheciopsis sp. (D)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 59374, 59375).
Saprophytic on fallen leaves.

Pleurotus opuntiae (Durieu & Léveillé) Saccardo, *Syll. Fung. 5:* 363, 1887 (B)
on *Araucaria heterophylla* (Salisb.) Franco (PDD 55006).
on *Rhopalostylis baueri* (Hook. f.) Wendl. & Druce var. *cheesemanii* Sykes (PDD 55042).

Polyporus rhipidium Berkeley (Cunningham 1950) = *Panellus pusillus*

Polystictus hirsutus (Wulfen) Fries (Oliver 1911) = *Trametes hirsuta*

Polystictus tabacinus (Montagne) Fries (Oliver 1911) = *Cyclomyces tabacinus*

Propolis emarginata (Cooke & Massee) Sherwood, *Mycotaxon 5*: 323, 1977 (A)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 54664, 54666).
Common throughout New Zealand on fallen leaves of *Metrosideros* spp.

Pseudocercospora atromarginalis (Atkinson) Deighton, *Mycol. Pap. 140*: 139, 1976 (D)
*on *Solanum americanum* Miller (PDD 54627).
Leaf blotch. Widespread in New Zealand on *Solanum* spp.

Pseudocercospora spp. (D)
*on *Coprosma acutifolia* Hook. f. (PDD 54793, 54794, 54795).
*on *Melicytus ramiflorus* J.R. & G. Forst. ssp. *ramiflorus* (PDD 54646).
On *Coprosma* circular to irregular leaf spots up to 1 cm diam., reddish-brown, larger spots sometimes becoming zonate. On *Melicytus* angular leaf spots 2-4 mm diam., white with a dark brown or black border. Less obvious

on lower surface of leaf and lacking a distinct border.

Pseudopeziza medicaginis (Libert) Saccardo, *Malpighia 1*: 454, 1887 (A)
on *Medicago nigra* (L.) Krocker (PDD 54641).
Leaf spot. Small, black lesions, with erumpent ascocarps within the larger spots. Common and widespread on *Medicago* spp. in New Zealand.

Pseudopeziza trifolii (Bivona-Bernardi) Fuckel, *Jahr. Nassau. Vereins Naturk. 23-4*: 290, 1870 (A)
on *Trifolium repens* L. (PDD 54614).
Leaf spot. Small, brown lesions, with erumpent ascocarps within the larger spots. Common and widespread on *Trifolium* spp. in New Zealand.

Pseudoseptoria stomaticola (Bäumler) Sutton, *The Coelomycetes*: 98, 1980 (D)
on *Microlaena stipoides* (Labill.) R. Br. (PDD 54643).
Halo spot. Common throughout New Zealand on many different grasses.

Puccinia caricina de Candolle, *Fl. Franç. 6*: 60, 1815 (B)
*on *Carex kermadecensis* Petrie (PDD 54803 - II).
Rust. This introduced species is widespread on indigenous *Carex* spp. in New Zealand.

Puccinia cnici Martius, *Prodr. Fl. Mosq., ed. 2*: 226, 1817 (B)
on *Cirsium vulgare* (Savi) Tenore (PDD 54649 - II).
Rust. Widespread in New Zealand.

Puccinia coronata Corda, *Icon. Fung. 1*: 6, 1837 (B)
*on *Poa anceps* Forst. f. ssp. *polyphylla* (Hack.) Edgar (PDD 54761 - II).
Crown rust. Common and widespread throughout New Zealand on many different grasses.

Puccinia cynodontis Lacroix in Desmazières, *Pl. Crypt. N France, ed. 2, sér. 2*: 655, 1859 (B)
on *Cynodon dactylon* (L.) Pers. (PDD 54669 - II).
Rust. Common and widespread in the North Island.

***Puccinia flaccida** Berkeley & Broome in Berkeley, *J. Linn. Soc., Bot. 14*: 91, 1873 (B)
on *Oplismenus hirtellus* (L.) Beauv. ssp. *imbecillis* (R. Br.) Roem. & Schult. (PDD 54756, 54757, 54758, 54759, 54760 - all II).
Rust. Previously known from Sri Lanka, India and Japan on *Oplismenus* spp.

Puccinia hieracii (Rohling) Martius var. **hieracii**, *Prodr. Fl. Mosq., ed 2*: 226, 1817 (B)
on *Taraxacum officinale* Weber ex Wiggers (PDD 54628 - II, III, 54629 - II, III).
Leaf rust. This species has become common on *T. officinale* since it was first observed in New Zealand on this host in 1978.

***Puccinia levis** (Saccardo & Bizz.) Magn. var. **panici-sanguinalis** (Rangel) Ramachar & Cummins, *Mycopathol. Mycol. Appl. 25*: 44, 1965 (B)
on *Digitaria ciliaris* (Retz.) Koel. (PDD 54762 - II, III, 54763 - II, III).
Rust. This tropical species is known from Central and South America, Sri Lanka, Pakistan, South-east Asia, and Pacific islands, on several different

grasses.

Puccinia ludwigii Tepper in Ludwig, *Bot. Centralb. 43*: 6, 1890 (B)
on *Rumex brownii* Campd. (PDD 54670 - II).
Rust. *R. brownii*, which is indigenous to Australia, is naturalised on Raoul Island. The rust was previously recorded only in Australia on *R. brownii* and other *Rumex* spp.

Puccinia microspora Dietel, *Bot. Jahrb. Syst. 37*: 101, 1905 (B)
on *Imperata cheesemanii* Hack. (PDD 54764 - II, III, 54765 - II, III); (McKenzie 1981 - Raoul Island, 1944, J.H. Sorensen, PDD 40291 - CHR 55406 - II; Raoul Island, 20 Nov 1964, W.R. Sykes, PDD 40290 - CHR 15325 - II; Raoul Island, 17 Aug 1969, W.R. Sykes, PDD 40289 - CHR 193711 - II, III; Raoul Island, PDD 39782 - CHR 367252 - II, III).
Rust. In New Zealand known only from Raoul Island, but occurs in Brazil, south-western United States, Japan, China, Borneo and Papua New Guinea on several species of grass.

Puccinia oxalidis Dietel & Ellis, *Hedwigia 34*: 291, 1895 (B)
on *Oxalis corniculata* L. (PDD 54767 - II).
Oxalis rust. This fungus has become common on *Oxalis* spp. since it was first observed in New Zealand in 1977.

Puccinia paspalina Cummins, *Bull. Torrey Bot. Club 72*: 211, 1945 (B)
on *Paspalum orbiculare* Forst. f. (PDD 54768 - II).
Rust. Widespread in tropics; in New Zealand previously known only from Northland.

Puccinia sp. (B)
on *Cenchrus calyculatus* Cav. (PDD 54650 - II, III).
Rust. This species differs from *Puccinia cenchri* Diet. & Holw., and appears to be new.

Pyricularia caricis Arnaud, *Bull. Soc. Mycol. Fr. 69*: 288, 1953 (D)
on *Carex kermadecensis* Petrie (PDD 54796).
On senescing leaves.

Ramichloridium sp. (D)
on *Meliolina sydowiana* on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 54825).
Overgrowing *Meliolina*.

Ramularia lapsanae (Desmazières) Saccardo, *Fungi Ital.*: 995, 1881 (D)
on *Lapsana communis* L. (PDD 54769).
Leaf spot. White powdery spore mass on lower surface of leaf. Widespread in New Zealand.

Ramularia rhabdospora (Berkeley & Broome) Nannfeldt in Lundell & Nannfeldt, *Fung. Exs. Suec. 39-40*: 32, 1950 (D)
on *Plantago lanceolata* L. (PDD 54626).
Leaf spot. White powdery spore mass on both surfaces of leaf. Widespread in New Zealand.

Rosellinia sp. (A)
on *Rhopalostylis baueri* (Hook. f.) Wendl. & Druce var. *cheesemanii* Sykes (PDD 54730).
On dead leaf.

Schizophyllum commune Fries, *Observ. Mycol. 1*: 103, 1815 (B)
on *Myoporum kermadecense* Sykes - W.R. Sykes, 30 Nov 1976 (PDD 40920).
on wood - W.R.B. Oliver, Oct 1908 (PDD 16754); (PDD 54612); (Oliver 1911).
Small white, fan-shaped, feathery bracket fructifications occur singly or in groups on wood. Common throughout New Zealand as a saprophyte and occasional wound pathogen.

Schizopora radula (Persoon) Hallenberg, *Mycotaxon 18*: 308, 1983 (B)
on *Coriaria arborea* Lindsay var. *kermadecensis* W.R.B. Oliver (PDD 55024, 59471).
Polypore fungus, forming resupinate basidiomata on dead wood of many different plants. Widespread in New Zealand.

Scorias spongiosa (Schweinitz) Fries, *Syst. Mycol. 3*: 291, 1832 (A)
on *Metrosideros kermadecensis* W.R.B. Oliver - Raoul Island, 1908, W.R. B. Oliver (PDD 16759); (Oliver 1911 - on *Metrosideros villosa*).
Sooty mould. A tropical and subtropical species known in New Zealand only from Raoul Island. Oliver (1911) stated that 'This fungus completely covers the upper branches of the pohutukawa-trees with a sooty black moss-like growth to a depth of 1/8 in. to 1/4 in. It continually sheds its black spores, so that the leaves of all trees and shrubs below are covered with a black deposit. Locally it is called 'pohutukawa soot'.'

Septonema sp. (D)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 59381).
Saprophytic on fallen leaves.

****Septoria coriariae*** Passerini, *Comment. Soc. Crittogam. ital. 2*: 435-476, 1867 (D)
on *Coriaria arborea* Lindsay var. *kermadecensis* W.R.B. Oliver (PDD 54804).
Leaf blotch. Lesions irregular 2-4 mm diam., grey. Previously recorded from South America.

Spiropes sp. (D)
on *Meliolina sydowiana* on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 54810).
Overgrowing and probably parasitic on *Meliolina*.

Stictis ramuligera Stärback var. ***ramuligera***, *Bih. Kongh. Svenska Vetensk.-akad. Handl. 25(14)*: 15, 1899 (A)
on *Cenchrus calyculatus* (PDD 54766).
Saprophytic on dead leaves of *Cenchrus*. Common throughout New Zealand, especially on dead fern fronds.

Taphrina deformans (Berkeley) L.R. Tulasne, *Ann. Sci. Nat. Bot. Ser. 5, 5*: 128, 1866 (B)
on *Prunus persica* (L.) Batsch (PDD 54610, 54640).
Leaf curl. Common throughout New Zealand on peach, apricot and nectarine trees.

Torrendiella eucalypti (Berkeley) Spooner, *Biblioth. Mycol. 116*: 322, 1987 (A)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 54660, 54667).
Saprophytic on fallen leaves. Occurs throughout New Zealand, especially

on *Metrosideros* spp.

Trametes hirsuta (Wulfen) Pilát, *Atlas Champ. Eur. 3*: 265, 1939 (B)
on wood - Raoul Island, Sep 1908, W.R.B. Oliver (PDD 17292); 16 May 1925, W.R.B. Oliver (PDD 39246); 9 Dec 1966, W.R. Sykes (PDD 26104); (Oliver 1911 - as *Polystichus* [sic] *hirsutus*); (Cunningham 1965 - in Kew under *Polystictus hirsutus* - 'Sunday Island, Oliver').
Polypore bracket fungus. Saprophytic on fallen and attached dead branches. Common and widespread in New Zealand on a wide range of plants.

Trametes menziesii (Berkeley) Ryvarden, *Norw. J. Bot. 19*: 236, 1972 (B)
(Cunningham 1950 - as *Coriolus blumei* - in Kew under *Polyporus subzonalis* - 'Christmas Island, Kermadecs, H.W. Rietz').
Polypore bracket fungus. Saprophytic on dead wood. Not known from mainland New Zealand, but occurs in Africa, India, South-east Asia, Australia, and Pacific islands. This record is confusing with the juxtaposition of Christmas Island and Kermadecs. *Polyporus subzonalis* has been recorded in Christmas Island, Indian Ocean (Shivas & Hilton 1990).

***Trametes ?pubescens** (Fries) Pilát, *Atlas Champ. Eur. 3*: 268, 1939 (B)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 55041, 55044).
Polypore bracket fungus. Saprophytic on dead wood. Worldwide in distribution, but not known from mainland New Zealand.

Trametes versicolor (Linnaeus) Pilát, *Atlas Champ. Eur. 3*: 261, 1939 (B)
on dead wood - 14 Jan 1967, W.R. Sykes (PDD 26136).
Polypore bracket fungus. A wound pathogen, sometimes associated with a white rot. Common and widespread on wood of many different plants in New Zealand.

Tranzschelia discolor (Fuckel) Transhel' & Litvinov, *Bot. Žurn. SSSR 24*: 248, 1939 (B)
on *Prunus persica* (L.) Batsch (PDD 54625 - II).
Leaf rust. Common throughout New Zealand on stone fruit.

Tubeufia helicoma (Phillips & Plowright) Pirozynski, *Mycol. Pap. 129*: 30, 1972 (A)
anamorph *Helicosporium pannosum* (Berkeley & Curtis) Moore, *Mycologia 49*: 582, 1957
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 54770, 54771).
Saprophytic on fallen leaves. Occurs throughout New Zealand on dead wood and leaves.

Tyromyces citreus (Berkeley) G.H. Cunningham, *Bull. N.Z. Dep. Scient. Ind. Res. 164*: 137, 1965 (B)
on ?*Coriaria arborea* Lindsay var. *kermadecensis* W.R.B. Oliver (PDD 55030).
Polypore bracket fungus. In mainland New Zealand known only in Northland and Auckland.

***Uredo** sp. (B)
on *Paspalum orbiculare* Forst. f. (PDD 54772).
Rust. This appears to differ from those rusts previously recorded on *Paspalum* spp. and may be new.

***Uromyces bidenticola** Arthur, *Manual Rusts U.S. and Canada*: 342, 1934 (B)
on *Bidens pilosa* L. (PDD 54609 - II, 54618 - II).
Leaf rust. Circumglobal in tropics on *Bidens* spp.

Uromyces danthoniae McAlpine, *Rusts of Australia*: 85, 1906 (B)
on *Rytidosperma racemosum* (R. Br.) Connor & Edgar (PDD 54773 - II).
Rust. This indigenous species is common on *Rytidosperma* spp. in New Zealand.

Uromyces tenuicutis McAlpine, *Rusts of Australia*: 87, 1906 (B)
on *Sporobolus africanus* (Poir.) Robyns & Tournay - 27 Mar 1949, A.C.S. Wright (PDD 40279 ex CHR 65385 - II); (PDD 54602 - II, III, 54605 - II, III).
Rust. Common in North Island, reflecting distribution of the host.

Verticicladiella sp. (D)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 59378, 59379).
Saprophytic on fallen leaves.

Wiesneriomyces sp. (D)
on *Metrosideros kermadecensis* W.R.B. Oliver (PDD 59363, 59376).
on *Rhopalostylis baueri* (Hook. f.) Wendl. & Druce var. *cheesemanii* Sykes (PDD 59364).
Saprophytic on fallen leaves.

MYXOMYCETES

Arcyria denudata (Linnaeus) v. Wettstein, *Verh. Zool.-Bot. Ges. Wien 35*: 535, 1885
(Oliver 1911 - as *Arcyria punicea*).

Arcyria punicea Persoon (Oliver 1911) = *Arcyria denudata*

***Didymium bahiense** Gottsberger, *Nova Hedwigia 15*: 365, 1968
on *Rhopalostylis baueri* var. *cheesemanii* (PDD 54596, 54598) - on dead leaf.

Didymium squamulosum (Albertini & Schweinitz) Fries, *Symb. gasteromyc.*: 19, 1818
on *Rhopalostylis baueri* var. *cheesemanii* (PDD 54598) - on dead leaf.

Fuligo septica (Linnaeus) Wiggers, *Prim. fl. holsat.*: 112, 1780
on *Metrosideros kermadecensis* (PDD 54594) - on dead wood.

Physarum compressum Albertini & Schweinitz, *Consp. fung. lusat.*: 97, 1805
on *Rhopalostylis baueri* var. *cheesemanii* (PDD 54596, 54598) - on dead leaf.

***Physarum melleum** (Berkeley & Broome) Massee, *Monogr. Myxogastr.*: 278, 1892
on *Rhopalostylis baueri* var. *cheesemanii* (PDD 54599) - on dead leaf.

Physarum pezizoideum** (Junghuhn) Pavillard & Lagarde var. ***microsporum Farr, *Brittonia 16*: 340, 1964
on *Rhopalostylis baueri* var. *cheesemanii* (PDD 54596, 54598) - on dead leaf.

Trichia decipiens (Persoon) Macbride, *N. Amer. Slime-moulds*: 218, 1899
on *Rhopalostylis baueri* var. *cheesemanii* (Oliver 1911 - as *Trichia fallax* - forest floor, on underside of dead leaves).

Trichia fallax Persoon (Oliver 1911) = *Trichia decipiens*

Trichia favoginea (Batsch) Persoon, *Neues Mag. Bot. 1*: 90, 1794
on *Metrosideros kermadecensis* (PDD 54595) - on dead wood.

Trichia floriformis (Schweinitz) G. Lister, *J. Bot. 57*: 110, 1919
on *Rhopalostylis baueri* var. *cheesemanii* (PDD 54597) - on dead leaf.

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- *Cordyline fruticosa*
  - *Cercospora* sp.
  - *Phyllosticta* sp.
- *Coriaria arborea* var. *kermadecensis*
  - *Schizopora radula*
  - *Septoria coriariae*
  - *Tyromyces citreus*
- *Corynocarpus laevigatus*
  - *Auricularia polytricha*
- *Cynodon dactylon*
  - *Puccinia cynodontis*
- *Cyperus brevifolius*
  - *Cercospora* sp.
  - *Dactylaria ?junci*
- *Cyperus ustulatus*
  - *Phyllachora cyperi*
- *Dactylis glomerata*
  - *Cercosporidium graminis*
- *Digitaria ciliaris*
  - *Puccinia levis*
    - var. *panici-sanguinalis*
- *Digitaria* sp.
  - *Cochliobolus cynodontis*
  - *Cochliobolus intermedius*
- *Euphorbia peplus*
  - *Melampsora euphorbiae*
- *Hibiscus rosa-sinensis*
  - *Botrytis cinerea*
- *Hibiscus tiliaceus*
  - *Glomerella cingulata*
- *Imperata cheesemanii*
  - *Colletotrichum ?falcatum*
  - *Puccinia microspora*
- *Ipomoea pes-caprae* ssp. *brasiliensis*
  - *Cercospora ipomoeae*
- *Lapsana communis*
  - *Ramularia lapsanae*
- *Lycopersicon esculentum*
  - *Fulvia fulva*
- *Medicago nigra*
  - *Pseudopeziza medicaginis*
- *Melicytus ramiflorus* ssp. *ramiflorus*
  - *Circinotrichum papakurae*
  - *Circinotrichum* sp.

  - *Clavaria* sp.
  - *Ellisiopsis gallesiae*
  - *Pseudocercospora* sp.
- *Meliolina sydowiana*
  - *Acrodontium crateriforme*
  - *Ramichloridium* sp.
  - *Spiropes* sp.
- *Metrosideros kermadecensis*
  - *Antrodiella* sp.
  - *Armillaria ?novae-zelandiae*
  - *Auricularia polytricha*
  - *Chloridium* sp.
  - *Coccomyces limitatus*
  - *Conoplea* sp.
  - *Cryptophiale* sp.
  - *Daldinia concentrica*
  - *Ellisiopsis gallesiae*
  - *Fuligo septica*
  - *Ganoderma applanatum*
  - *Gyrothrix* sp.
  - *Hymenoscyphus* sp.
  - *Lenzites vespacea*
  - *Meliolina sydowiana*
  - *Olidodendron* sp.
  - *Panellus pusillus*
  - *Phellinus senex*
  - *Plectania platensis*
  - *Pleurotheciopsis* sp.
  - *Propolis emarginata*
  - *Scorias spongiosa*
  - *Septonema* sp.
  - *Torrendiella eucalypti*
  - *Trametes ?pubescens*
  - *Trichia favoginea*
  - *Tubeufia helicoma*
  - *Verticicladiella* sp.
  - *Weisneriomyces* sp.
- *Microlaena stipoides*
  - *Cercospora microlaenae*
  - *Pseudoseptoria stomaticola*
- *Myoporum kermadecense*
  - *Schizophyllum commune*
- *Myrsine kermadecensis*
  - *Ganoderma applanatum*
- *Oidium* sp.
  - *Ampelomyces quisqualis*
- *Oplismenus hirtellus* ssp. *imbecillis*
  - *Puccinia flaccida*
- *Oxalis corniculata*
  - *Puccinia oxalidis*
- *Paspalum conjugatum*
  - *Cochliobolus cynodontis*
  - *Periconia echinochloae*
- *Paspalum dilatatum*
  - *Ascochyta paspali*
- *Paspalum orbiculare*
  - *Puccinia paspalina*
  - *Uredo* sp.
- *Passiflora edulis*
  - *Glomerella cingulata*
- *Phoenix dactylifera*
  - *Graphiola phoenicis*
- *Phyllostachys* sp.
  - *Apiospora montagnei*
- *Plantago lanceolata*
  - *Ramularia rhabdospora*
- *Poa anceps* ssp. *polyphylla*
  - *Bipolaris* sp.
  - *Lophodermium gramineum*
  - *Puccinia coronata*
- *Poa annua*
  - *Colletotrichum graminicola*
- *Polypogon monspeliensis*
  - *Colletotrichum graminicola*
- *Prunus persica*
  - *Taphrina deformans*
  - *Tranzschelia discolor*
- *Puccinia flaccida*
  - *Eudarluca caricis*
- *Puccinia microspora*
  - *Eudarluca caricis*
- *Puccinia paspalina*
  - *Eudarluca caricis*
- *Rhopalostylis baueri* var. *cheesemanii*
  - *Crepidotus* sp.
  - *Didymium bahiense*
  - *Didymium squamulosum*
  - *Gyrothrix* sp.
  - *Hypocrea* sp.
  - *Lachnella sulphurea*
  - *Lachnella* sp.
  - *Nectria* sp.
  - *Physarum compressum*
  - *Physarum melleum*
  - *Physarum pezizoideum*
  - *Pleurotus opuntiae*
  - *Rosellinia* sp.
  - *Trichia decipiens*
  - *Trichia floriformis*
  - *Wiesneriomyces* sp.
- *Ricinus communis*
  - *Auricularia polytricha*
- *Rumex brownii*

  - *Puccinia ludwigii*
- *Rytidosperma racemosum*
  - *Uromyces danthoniae*
- *Solanum americanum*
  - *Pseudocercospora atromarginalis*
- *Sporobolus africanus*
  - *Cochliobolus ravenelii*
  - *Uromyces tenuicutis*
- *Stenotaphrum secundatum*
  - *Magnaporthe grisea*
- *Taraxacum officinale*
  - *Puccinia hieracii* var. *hieracii*
- *Tranzschelia discolor*
  - *Eudarluca caricis*
- *Trifolium dubium*
  - *Cercospora zebrina*
  - *Microsphaera trifolii*
- *Trifolium repens*
  - *Mycosphaerella killianii*
  - *Pseudopeziza trifolii*
- *Tropaeolum majus*
  - *Acroconidiella tropaeli*
- *Veronica persica*
  - *Erysiphe cichoracearum*

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AMAURASCOPSIS, A NEW GENUS OF EUROTIALES

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ABSTRACT

Amaurascopsis perforatus **gen. nov., sp. nov.** is described and illustrated. The species has ascomata with a hyphal wall and globose ascospores with a loose pitted epispore (sheath), its anamorph is a ***Chrysosporium***. ***Amaurascopsis*** is compared with other genera of Eurotiales. It is considered to be in the Amauroascaceae. The following new combination is proposed: ***Amaurascopsis reticulatus*** (Kuehn et Goos) Guarro et Gené, **comb. nov**.

INTRODUCTION

During a study of gymnoascaeous and related fungi, from world wide origin, isolated and/or deposited at the Institute of Tropical Medicine 'Prince Leopold' of Antwerpen (Belgium) an interesting fungus was found to differ from the known species of the Eurotiales and we believe also represents a new genus. It is described below.

TAXONOMY

Amaurascopsis Guarro, Gené et de Vroey, **gen. nov**.

Ascomata discreta vel absens, plus minusve globosa, aurantiacea vel brunneola, peridium ex crassis hyphis asperulatis anastomosantibus eferet et reticulum efformant, asci globosi vel ovoidei, hyalini, evanescenti, octosporati; ascosporae plus minusve globosae, flavae usque aurantiaceae, crassi-tunicatae, cum strato mucido irregulariter perforato praeditae; status asexualis ***Chrysosporium*** *est.*

Species typica: ***Amaurascopsis perforatus*** Guarro, Gené et De Vroey.

Colonies felty, white, composed of hyaline often fasciculate hyphae. **Ascomata** discrete or lacking, more or less globose, orange to brownish, with a peridium composed of rather thick asperulate, anastomosing hyphae. **Asci** spherical to ovoid, hyaline, evanescent, 8-spored. **Ascospores** globose to subglobose, yellow to orange, with a rather wall thick surrounded by an irregularly pitted to reticulate sheath. **Anamorph** represented by ***Chrysosporium*** conidia.

Amaurascopsis perforatus Guarro, Gené et De Vroey, **sp. nov.** (Figs. 1,2,3,4)

Ascomata discreta, plus minusve globosa, aurantiacea vel brunneola, 55-170 μm diametri, peridium ex crassis hyphis anastomosantibus eferet et reticulum efformant, hyphis 1.8-3.0 μm latis et asperulatis. Asci globosi vel ellipsoidei, 9.0-10.5 x 8.0-9.0 μm, octosporati, evanescentes, hyalini. Ascosporae plus minusve globosae, 3.5-4.5(-5.0) x 3.5-4.5 μm, flavae usque aurantiaceae, crassi-tunicatae, cum strato mucido irregulariter perforato praeditae. Conidia terminalia vel intercalaria, nonnumquam lateralia. Conidia terminalia in rectis vel flexuosis ramulibus lateralibus oriunda, solitaria, subhyalina, subglobosa, pyriformia vel obovoidea (3.0)4.0-6.5(7.5) x 2.5-4.5 μm, crassi-tunicata, asperulata vel tuberculata. Conidia intercalaria copiosa, solitaria, subhyalina, plus minusve cylindrica, 4.0-9.0 x 2.0-5.0 μm, crassi-tunicata, asperulata vel tuberculata.

Cultura typica: *ex solo, in collectione fungorum IMI, Kew, Britannia deposita est.* **Isotypus** FMR 3882.

Ascomata discrete, orange to brownish orange when mature, globose to subglobose, 55-170 μm diam., peridium with anastomosing hyphae; **peridial hyphae** abundant, 1.8-3.0 μm wide, pale orange, wall thick, asperulate, sligthly constricted at the septa, with rounded apices, distinct appendages absent. **Asci** globose to broadly ellipsoidal, 9.0-10.5 x 8.0-9.0 μm, 8 spored, hyaline, evanescent. **Ascospores** globose, occasionally subglobose, 3.5-4.5(-5.0) x 3.5-4.5 μm, light yellow to light orange, wall thick, with a loose irregularly pitted perispore membrane (sheath). **Anamorph** represented by terminal and intercalary conidia, occasionally lateral. Terminal conidia on lateral, straight or slightly curved branches, solitary, subglobose, clavate to obovate, subhyaline, (3.0)4.0-6.5(7.5) x 2.5-4.5 μm, wall thick, smooth when young, later coarsely roughened to tuberculate; intercalary conidia very abundant, solitary, cylindrical to barrel-shaped, 4.0-9.0 x 2.0-5.0 μm, wall thick, coarsely roughened to tuberculate.

Colonies on oat-meal agar (OMA) reaching 24-25 mm diam. in 14 days at 25°C, white to cream-coloured, superficial mycelium dense, flat, velvety at the centre and downy at the periphery, margin irregular, slightly arachnoid, submerged mycelium reddish brown exceeding by 1-2 cm the diameter of the superficial mycelium, reverse brownish violet; the ascomata are produced in 25 days; at 37°C colony growth is slightly faster (23-30 mm diam. in 14 days) the colonies are similar but the reverse is violet brown and the ascomata appear later (in 30 or more days).

On phytone yeast extract (PYE) at 25°C the colonies are 14-16 mm diam. in 14 days, white, moist, floccose to fasciculate, raised and rugose at the centre, velvety and folded at the periphery, with a slightly lobate margin, reverse colourless to pale brown; reaching 16-17 mm diam. in 14 days at 37°C, orange white, aerial mycelium scant, waxy with floccose areas, margin regular, reverse brown. The production of ascomata on PYE was not observed.

On potato dextrose agar (PDA) the colonies reach 20-25 mm diam. in 14 days

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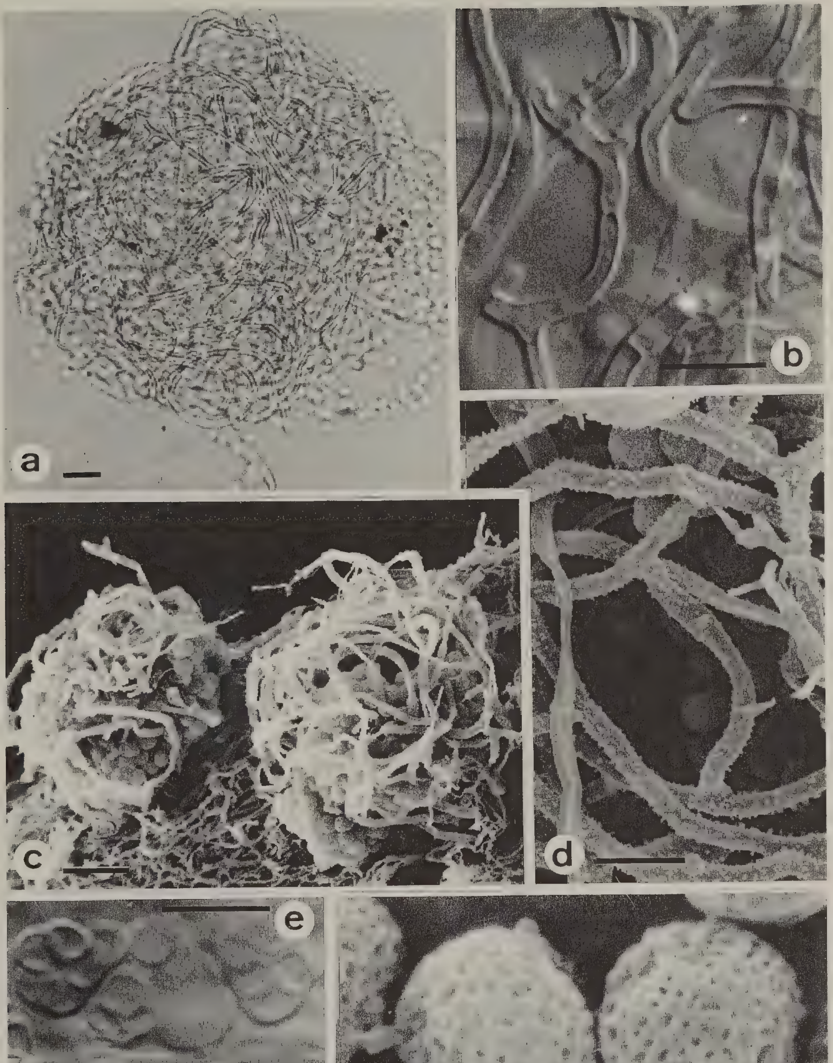
Fig. 1. ***Amaurascopsis perforatus*** (FMR 3882). **a,c**, Ascomata (bar=10 μm). **b**, Peridial hyphae (bar=10 μm). **d**, Peridial hyphae and ascospores (bar=5 μm). **e**, Asci (bar=10 μm). **f,g**, Ascospores (**f**, bar=1 μm; **g**, bar=5 μm). ***Amaurascopsis reticulatus*** (UAMH 3560). **h**, Ascospores (bar=5 μm).


a
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at 25°C, cream-coloured, superficial mycelium flat, velvety, sometimes slightly cottony, margin irregular, arachnoid; submerged mycelium greyish red exceeding by 6-10 mm the diameter of the superficial mycelium, reverse reddish brown; at 37°C the colonies measure 28-30 mm diam. in 14 days, aerial mycelium scant, white, slightly floccose, folded, with the cracking of the medium, submerged mycelium greyish ruby, reverse greyish red. In this medium ascomata are not produced.

Material examined: FMR 3882 (=RV 24813), isolated in Antwerp with the spray technique of Orr (Kuehn *et al.*, 1961) from a soil sample (chicken yard) collected by P. Dockx in Burundi, June 1968. The holotype has been deposited in the IMI, Kew, England.

In a recent paper Guarro *et al.* (1991) included a key to eight genera of Eurotiales with globose ascospores. Of these, only ***Apinisia*** La Touche and ***Arachnotheca*** v. Arx have ascospores surrounded by a sheath, but both are easily differentiated from ***Amaurascopsis*** by the coiled peridial appendages in ***Apinisia*** and by typical anamorph of ***Arachnotheca*** which consists in arthroconidia separated by disjunctives. Furthermore the ascospores of these two genera are hyaline. ***Auxarthron*** Orr et Kuehn and ***Amauroascus*** Schröt. are two other genera of Amauroascaceae very close to ***Amaurascopsis*** and which are separated with difficulty. The presence of the sheath on the ascospores of ***Amaurascopsis*** is the main difference with such genera. ***Amauroascus*** and ***Auxarthron*** are normally distinguished by the type of peridium which in the former is poorly differentiated or absent and in the latter is covered by stiff, often branched appendages or setae. However, this distinction is not clear because some exceptions exist (Currah, 1985; Cano et Guarro, 1989). Currah (1985) excluded ***A. reticulatus*** (Kuehn et Goos) v. Arx from ***Amauroascus*** because it is not keratinophilic and its ascospores are embedded in a mucilaginous sheath. We think that this species shares the generic character of ***A. perforatus*** and thus the following new combination is proposed.

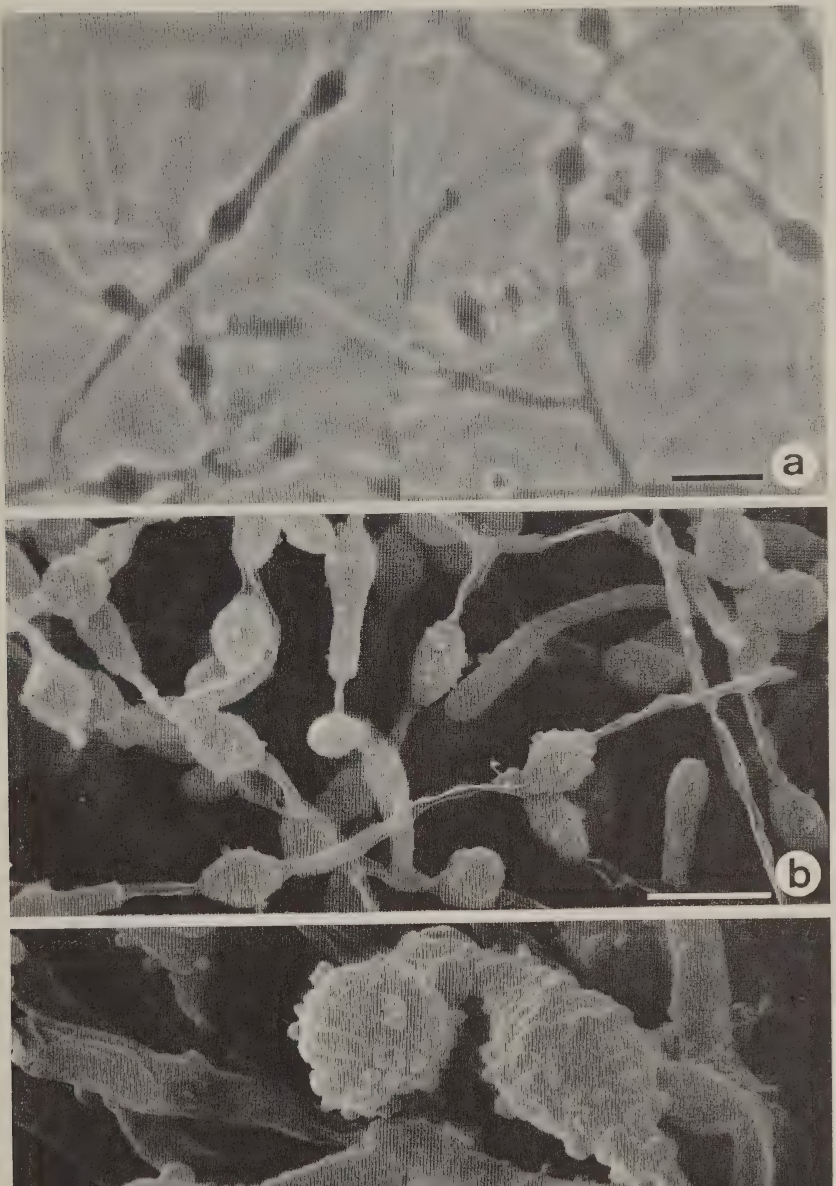
Amaurascopsis reticulatus (Kuehn et Goos) Guarro et Gené, **comb. nov**. (Fig. 1h)
≡***Pseudoarachniotus reticulatus*** Kuehn et Goos, Mycologia 52:40 (1960).
≡***Amauroascus reticulatus*** (Kuehn et Goos) v. Arx, Persoonia 6:375 (1971).

Material examined: UAMH 3560, UAMH 3870, UAMH 3871 from University of Alberta, Microfungus Collection and Herbarium.

The ascospores size in both species of ***Amaurascopsis*** is very similar (5-6 µm in ***A. reticulatus***) but in the latter the peridial hyphae are absent and there is no anamorph. According to the classification of v. Arx (1987), ***Amaurascopsis*** is a typical member of the family Amauroascaceae.

The anamorph of ***A. perforatus*** is a ***Chrysosporium*** characterized by the abundance of verrucose intercalary conidia. It is very close to ***C. merdarium*** (Link ex Grev.) Carmichael but this usually has pink to pale green colonies and does not grow at 37°C, while the colonies of ***A. perforatus*** are white and grow very well at such temperature. Another strain of ***Chrysosporium*** (FMR 3972), not yet described, is also

Fig. 2. ***Chrysosporium*** anamorph of ***Amaurascopsis perforatus***. **a**, bar=10 µm; **b**, bar=5 µm; **c**, bar=2 µm.


a
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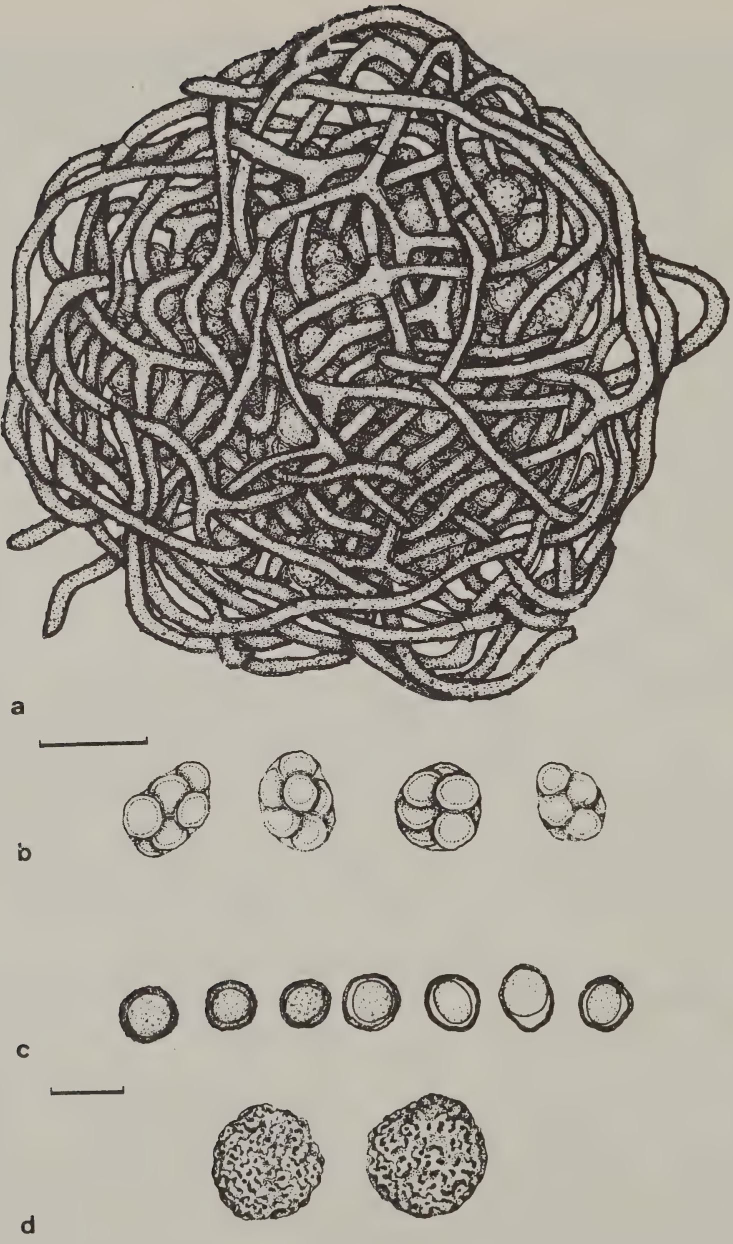

Fig. 3. ***Amaurascopsis perforatus***. **a**, Ascoma (bar=10 μm). **b**, Asci (bar=10 μm). **c**,**d**, Ascospores (**c**, bar=4 μm; **d**, bar=2 μm).

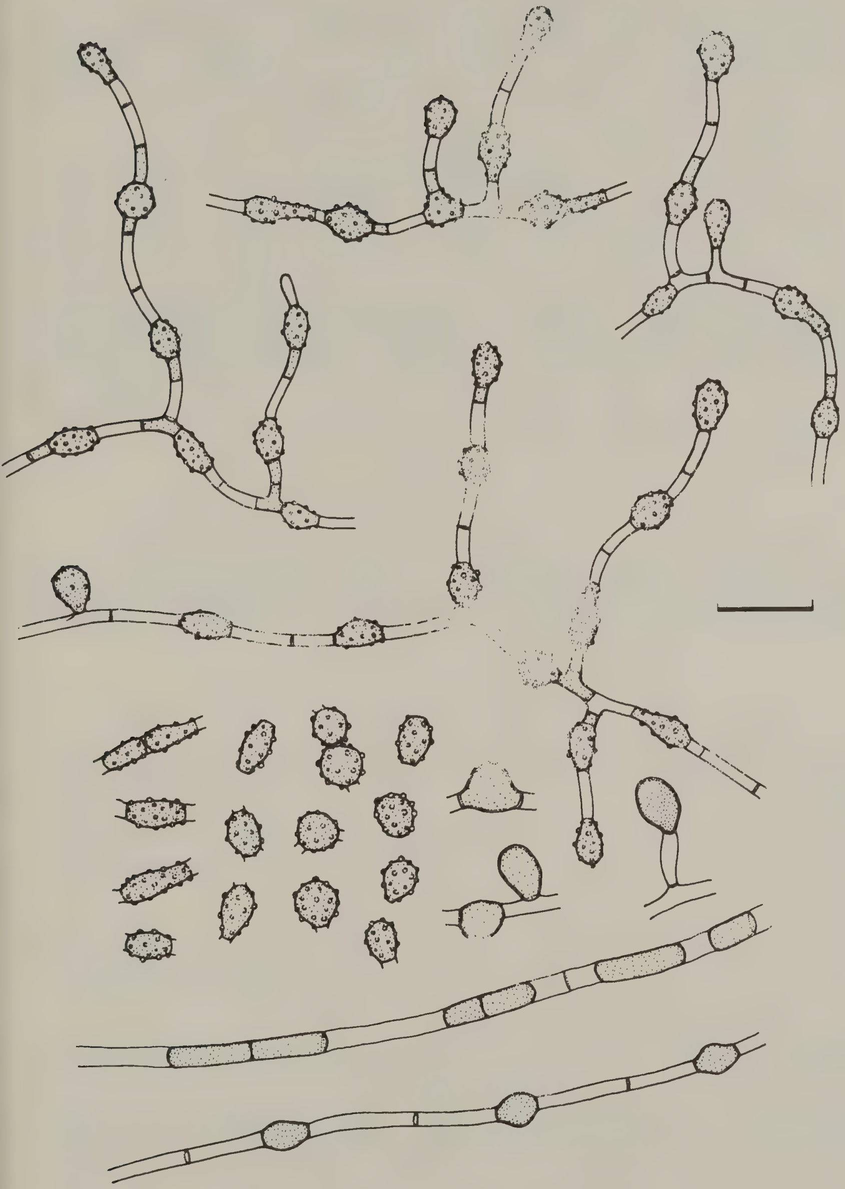

Fig. 4. ***Chrysosporium*** anamorph of ***Amaurascopsis perforatus*** (bar = 10 μm).

similar to the anamorph of ***A. perforatus***, but at 37°C it grows very poorly, the reverse of the colonies being light yellow. There is a predominance of lateral conidia and it is not associated with a teleomorph. Most species of the complex ***Amauroascus/ Auxarthron*** have ***Malbranchea*** anamorphs, but only a few species of ***Amauroascus*** (***A. aureus*** (Eidam) v. Arx and ***A. volatilis-patellus*** (Orr et Kuehn) Currah) have ***Chrysosporium*** anamorphs.

Kimbrough (1989), in a new delimitation of the family Pyronemataceae (Pezizales), proposed the inclusion of ***Amauroascus*** in this family. We believe that so far there are not enough reasons to separate this genus from the Eurotiales because of its habitat and anamorphs (v. Arx, 1987). We do not know of any published data concerning the presence of complex ascal pores or of an operculum on the asci which could justify redisposition. Besides, in several species of ***Amauroascus*** the asci are surrounded by a peridium formed by a network of more or less differentiated hyphae, which is never seen in the Pezizales. Perhaps in ***A. verrucosus*** (Eidam) Schroeter or in some other species there exist a few characters which recall some features of the Pezizales but in our opinion their relations with the rest of the species of ***Amauroascus*** are stronger than with the Pezizales.

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HORMOGRAPHIELLA, A NEW GENUS OF HYPHOMYCETES FROM CLINICAL SOURCES

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ABSTRACT

A new hyphomycete genus, ***Hormographiella***, commonly found in clinical sources, is described. The more distinguishable features are its erect conidiophores with whorls of fertile hyphae that form arthroconidia and good colony growth at 37°C. Three new species are included, ***H. arpergillata, H. candelabrata*** and ***H. verticillata***.

INTRODUCTION

In the last year we have had the opportunity to study three strains of an arthroconidial fungus isolated from clinical sources in Western Europe. Another isolate from goat dung shares the same generic characteristics. All have broad erect conidiophores with whorls or tufts of fertile hyphae at the apex, which form arthroconidia seceding by schizolysis. Cultures grow well at 37°C. We describe them as new species in a new anamorph genus.

TAXONOMY

Hormographiella Guarro et Gené, **gen. nov.**
(Etym: similar to ***Hormographis***)

Coloniae celeriter crescunt ad 37°C, albae vel cremeae. Hyphae vegetativae hyalinae, septatae, ramosae. Conidiophora erecta, macronematosa vel semi-macronematosa, mononematosa, simplicia vel interdum ramosa, hyalina, septata, cum apice iterum sympodialiter ramoso. Hyphae conidiogenae discretae, in verticillis lateralis et terminalis, septatae, conidiorum secessio schizolytica. Conidia catenata, laevia, cylindrica, hyalina, utrimque truncata, non-septata. Reproductio sexualis ignota.
Species typica: ***Hormographiella aspergillata*** Guarro, Gené et De Vroey.

Colonies growing very quickly at 37°C, white or cream-coloured. Vegetative hyphae hyaline, septate, branched. Conidiophores erect, macro- to semi-macronematous, mononematous, simple or branched, hyaline, septate, frequently elongating by repeated sympodial proliferation. Conidiogenous hyphae on the conidiophore simple or branched, lateral or terminal, frequently in whorls, which fragment to form arthroconidia. Conidia catenate, hyaline, smooth, with one or both ends truncate, without frills or disjunctives after release, cylindrical, non-septate. Teleomorph unknown.

Type species: ***Hormographiella aspergillata*** Guarro, Gené et De Vroey, **sp. nov.**

The genus ***Hormographiella*** is close to some arthroconidial states of Basidiomycotina described by Sigler and Carmichael [6]. They all show similar colony appearance, characterized especially by their rapid growth and by the white or pale tan colour. But generally, the basidiomycete strains do not grow at 37°C while those of ***Hormographiella*** grow faster at this temperature than at 25°C. We have not observed the presence of clamp connections. Besides their temperature response, the main difference between ***Hormographiella*** and the strains described by Sigler and Carmichael is the absence in the latter of well-defined and erect conidiophores.

Other genera with erect, hyaline conidiophores and arthroconidia are ***Arthrographis*** (Cochet) Sigler et Carmichael [6,7], ***Hormographis*** Guarro, Punsola et Arx [3], the anamorph of the basidiomycete ***Peniophora gigantea*** (Fr.) Massee [3], and the anamorphs of the ascomycetes ***Pezizella chapmanii*** Whitney et Funk [8], ***Xylogone sphaerospora*** Arx et T. Nilsson [1] and ***Arachnotheca glomerata*** (Müller et Pacha-Aue) Arx [2]. In all these genera conidiogenous hyphae and conidiophores have the same width, while in ***Hormographiella*** the conidiophore is clearly broader than the conidiogenous hyphae. Besides, in ***Hormographis*** the conidiophores are synnematous and conidia are usually 1-septate and separated from each other by empty segments. Other similar genera are ***Geomyces*** Traaen [6] and ***Botryomonilia*** Goos et Pirozynski [4]. In the former the conidia are doliiform, cuneiform or pyriform and separated by lysis of intervening segments, while the latter has a penicil of branched conidiogenous hyphae which form arthroconidia with disjunctives.

Other genera with arthroconidia but which can be differentiated easily by their pigmented structures are ***Sympodiella*** Kendrick, ***Oidiodendron*** Robak emend. Udagawa et Toyazaki, ***Staheliella*** Van Emden, ***Coremiella*** Bubak et Krieger, ***Arthropsis*** Sigler *et al.*, ***Amblyosporium*** Fresenius, ***Charomyces*** Seifert, ***Rhexoampullifera*** Kirk and ***Briosia*** Cavara.

Three of the four strains of ***Hormographiella*** reported here are from clinical sources in Spain, Belgium and France; two of them from skin lesions and the third from a catheter. In no case the causal relationship with the diseases was proven. It is probable that the good growth shown by these fungi at 37°C is the result of their adaptation to the environmental conditions of the human body.

KEY TO THE SPECIES

1a. Conidiophores well differentiated, with globose slimy conidial heads . . . . ***H. aspergillata***
1b. Without such characteristics 2
2a. Conidiogenous hyphae long (with up to 7 conidia each) and frequently branched . . . . ***H. candelabrata***
2b. Conidiogenous hyphae short (with not more than 3 conidia each) and unbranched . . . . ***H. verticillata***

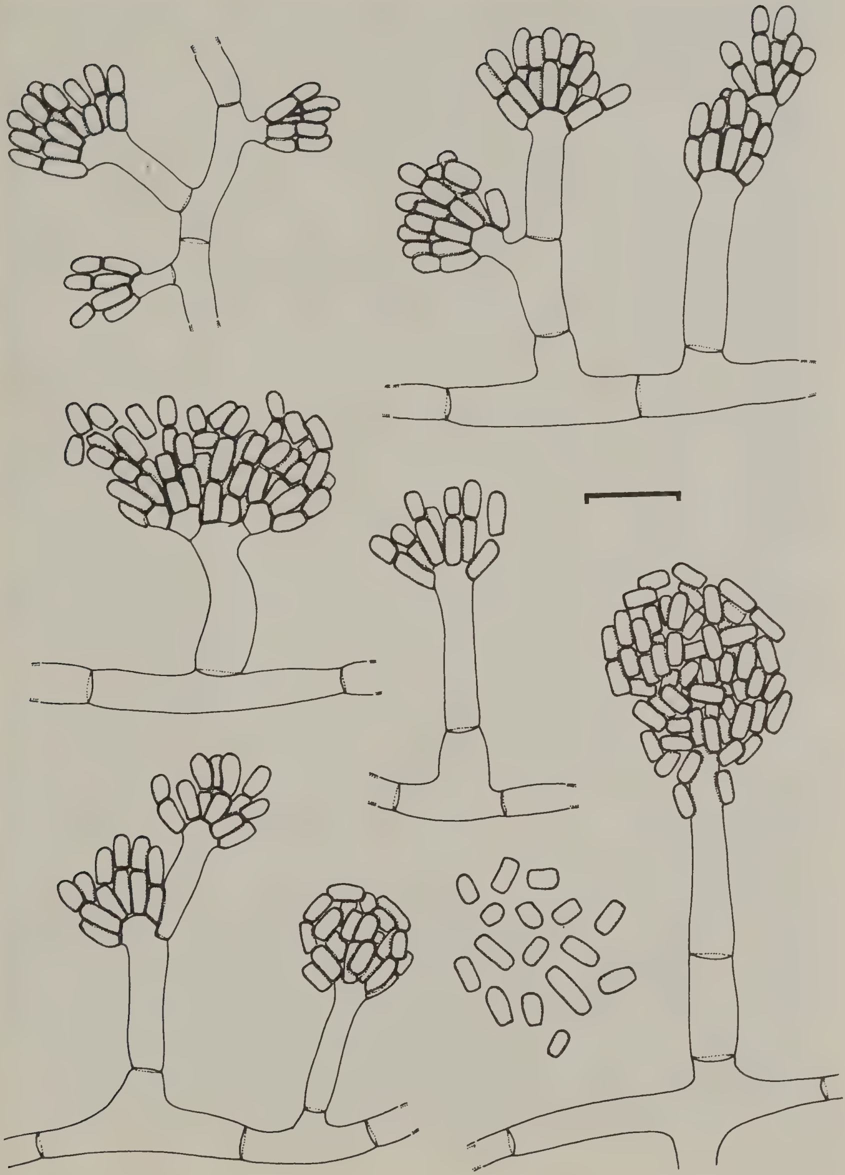


Fig. 1. ***Hormographiella aspergillata*** IMI 349604 (bar = 10 μm).

Hormographiella aspergillata Guarro, Gené et De Vroey, **sp. nov.**
(Etym: similar to ***Aspergillus***) (Figs. 1,2)

Coloniae in agaro farinae avenae ad 25°C moderatim crescunt, 30-35 mm diametri post 14 dies, albae vel cremeae, lanosae vel floccosae, ad margine irregulares, reverso incolorato. Ad 37°C celeriter crescentes. Hyphae hyalinae, septatae, laeves vel verruculosae, 2-5 μm crassae. Conidiophora erecta, macronematosa, nonnumquam semi-macronematosa, mononematosa, 8-55 x 2.5-5.5 μm, singularia vel interdum ramosa, hyalina, septata, cum apice iterum sympodialiter ramoso. Hyphae conidiogenae discretae, in verticillis, usque ad 16 in numero, lateralis et terminalis, 5-14 x 1.9-3 μm, septatae, conidiorum secessio schizolytica. Conidia catenata, laevia, cylindrica, (2.5)3.5-6(6.5) x (1.5)2-2.5(3) μm, hyalina, utrimque truncata, non-septata.

Cultura typica: IMI 349604, *ex homine,* 2 Feb. 1979. **Isotypus** FMR 3839.

Colonies on oat-meal agar (OMA) at 25°C reaching 30-35 mm diam. in 14 days, white or cream-coloured, aerial mycelium scant at the center, downy, sparse to floccose towards the periphery, margin irregular, reverse colourless. At 37°C it grows luxuriantly filling the Petri-dish in 14 days, white to yellowish white, aerial mycelium dense, patchy, usually with white mycelial tufts, margin irregular, in time the colony becoming flattened, felt-like and mottled pale tan, with abundant production of hyaline or yellowish droplets of exudate.

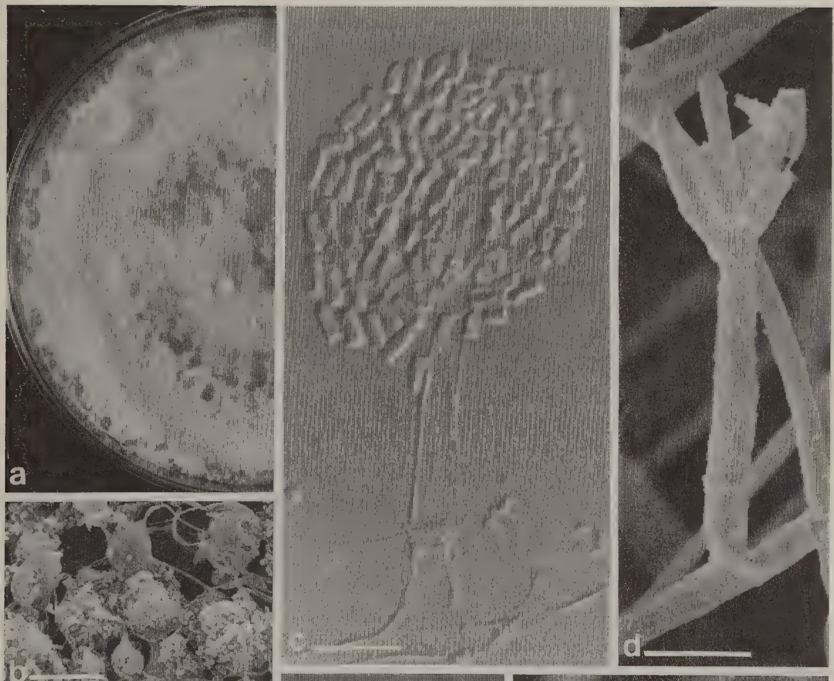
On Phytone yeast extract agar (PYE) at 25°C the colonies reaching 15-20 mm diam. in 14 days, white at first but becoming cream-coloured or pale tan very soon, matted, slightly raised at the centre, downy and plane at the margin, reverse colourless. At 37°C it grows more rapidly, 40-60 mm diam. in 14 days, the rest of the features being similar.

On YpSs it has practically the same characteristics as on OMA.

Vegetative hyphae hyaline, septate, smooth or roughened, 2-5 μm broad. Conidiophores macronematous, occasionally semi-macronematous (FMR 3786), mononematous, 8-55 x 2.5-5.5 μm (in the middle), 5-8 μm broad at the base and tapering to the apex, smooth or scarcely verrucose, septate, simple or elongating by repeated sympodial proliferation, producing 1 or 2, rarely 3 lateral branches, the apex of each branch is swollen and bears a cluster of conidiogenous hyphae variable in number, up to 16, frequently 4-12. Conidiogenous hyphae 5-14 x 1.9-3 μm, becoming septate in basipetal sequence or at random, unbranched, very rarely with one branch at the base (FMR 3786). Conidia catenate, 2-3 in number, separated from each other by sets of paired septa, there are no disjunctives or separating cells, conidia remaining on the apex in globose slimy heads; 1-celled, hyaline, smooth, cylindrical, (2.5)3.5-6(6.5) x (1.5)2-2.5(3) μm, truncate at both ends, terminal conidia apically rounded.

Material studied: IMI 349604 (=RV 41960, FMR 3839), isolated from human skin lesions in Belgium, 1978. IMI 349603 (=FMR 3786) from human prepuce lesions, Hospital Verge de la Cinta, Tortosa, Spain, 11 Oct. 1990.

Fig. 2. ***Hormographiella aspergillata*** (***a-c***, IMI 349604; ***d-i***, IMI 349603). ***a,b***, colony morphology after 14 days at 37°C (*b* bar=25 μm); ***c-e***, conidiophores (*c* bar=10 μm; *d,e* bar=5 μm); ***f,i***, conidial heads (*f* bar=5 μm; *i* bar=2 μm); ***g,h***, conidia (*g* bar=2 μm; *h* bar=5 μm).


a
b
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Hormographiella candelabrata Gené et Guarro, **sp. nov.**
(*Etym*: conidiophores resembling a candelabra = latin, *candelabrum*) (Figs. 3,4)

Coloniae in agaro farinae avenae ad 25 °C post 14 dies, cum rapiditate crescunt, 70-75 mm diametri, albae vel dilutae brunneae, planae, in medio granulatae, in parte marginale floccosae vel gossypinae, cum marginibus irregularibus, reverso incolorato. Ad 37 °C moderatim crescunt, 60-65 mm diam. post 14 dies. Hyphae hyalinae, septatae, laeves vel verruculosae, 1.5-4 µm crassae. Conidiophora erecta, macronematosa, nonnumquam semi-macronematosa, mononematosa, 6-100(170) x 1.5-3 µm, singularia vel interdum ramosa, hyalina, septata, cum apice iterum sympodialiter ramoso. Hyphae conidiogenae discretae, simpliciae vel ramosae, septatae, divergentes, in verticillis, usque ad 10 in numero, lateralis et terminalis, 7-20 x 1-2.5 µm. Conidia catenata, 2-7 in numero, singularia vel ramosa, laevia, anguste cylindrica, (2)3-7(12) x (0.8)1-1.8(2.5) µm, hyalina, utrimque truncata, nonseptata.

Cultura typica: IMI 349602, *ex fimo caprae*, 10 Aug. 1989. **Isotypus** FMR 3782.

Colonies on OMA at 25 °C growing moderately fast, reaching 70-75 mm diam. in 14 days, white in the centre and pale tan at the margin, flat, compact, granular at the centre, floccose to cottony at the periphery, margin irregular, reverse colourless. At 37 °C, colonies slightly more restricted (60-65 mm diam. after 14 days), white to cream-coloured, aerial mycelium sparse, downy, patchy, margin arachnoid, submerged mycelium with margin plumose excceding by 1-1.5 cm the diameter of the superficial mycelium, reverse colourless; when dried, the aerial growth flattens becoming felt-like and mottled tan.

The colony on PYE at 25 °C reaching 52-55 mm diam. in 14 days, white, aerial mycelium scant, downy, patchy with small floccose portions, reverse colourless. At 37 °C it grows more slowly, 35-40 mm diam. in 14 days, the rest of the characters remaining similar to those above.

On YpSs at 25 °C the colonies reach 43-45 mm diam. in 14 days, white, aerial mycelium scant, downy, patchy, margin irregular, reverse pale tan. At 37 °C growth is similar but more luxuriant filling 9 cm Petri-dish in 14 days.

On 2% MEA at 25 °C the colonies reach 30-40 mm diam. in 14 days, initially cream-coloured becoming mottled brownish orange, aerial mycelium scant, downy, sometimes appearing as white mycelial tufts, flat to rugose, margin irregular, submerged mycelium with margin plumose more extended than aerial mycelium, reverse hyaline to brownish yellow especially in the centre. At 37 °C growth is faster (60-65 mm diam. in 14 days), white, velvety to floccose, margin regular but diffuse, reverse colourless. On this medium sporulation is relatively poor.

Vegetative hyphae hyaline, septate, smooth or delicately roughened, 1.5-4 µm broad, sometimes with swollen cells up to 7-10 µm broad. Conidiophores arising from aerial hyphae, macronematous, sometimes semi-macronematous, mononematous, very variable in length, 6-100(170) x 1.5-4 µm, smooth, septate or non septate, simple and frequently with a verticil of conidiogenous hyphae at their swollen apex, or branched, elongating by repeated sympodial proliferation, each branch producing a verticil of conidiogenous hyphae apically, up to 10 in number. Conidiogenous hyphae simple or branched, 7-20 x 1-2.5 µm, divergent, fragmenting in basipetal sequence or at random. Conidia catenate, 2-5 in number, sometimes up to 7, separated from each other by pairs of adjacent septa, narrow-cylindrical, non septate, hyaline, smooth, (2)3-7(12) x (0.8)1-

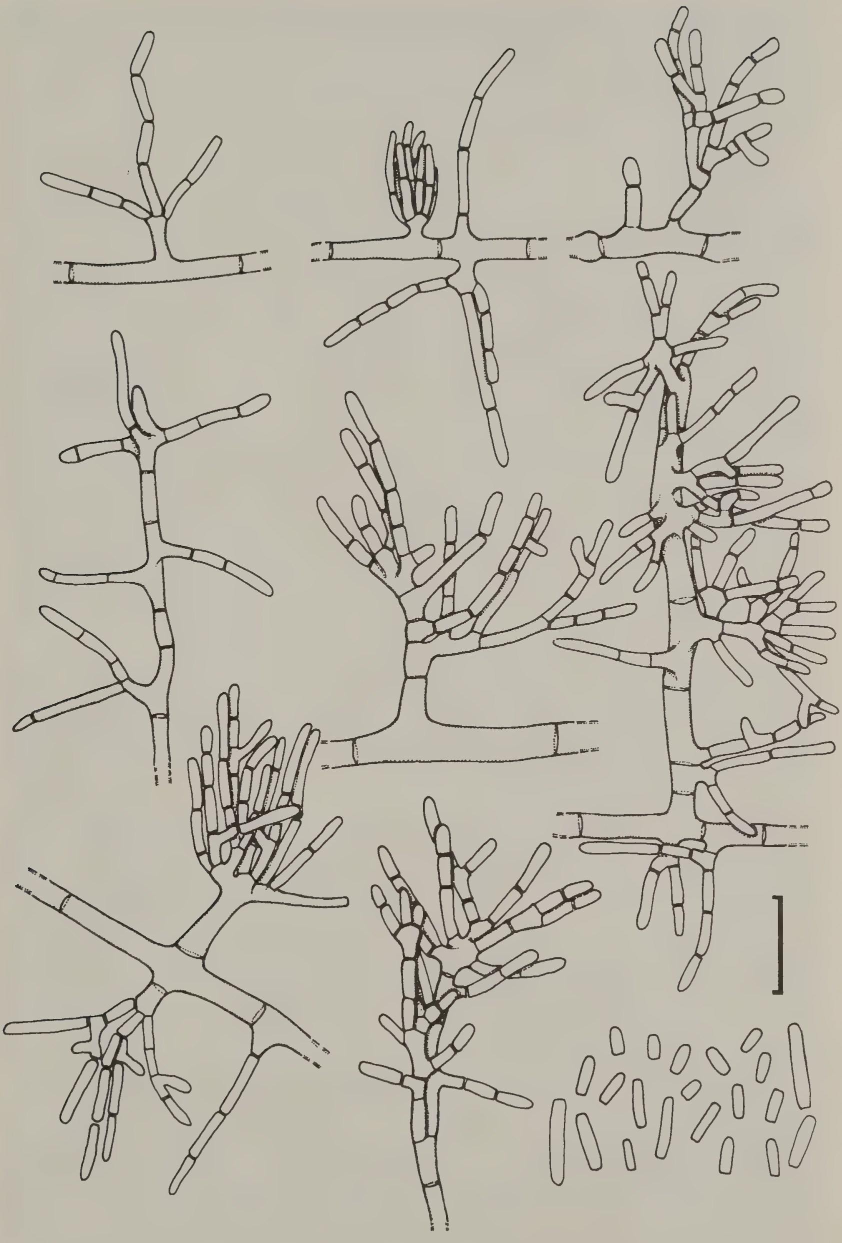


Fig. 3. ***Hormographiella candelabrata*** IMI 349602 (bar = 10 μm).

1.8(2.5) μm, intercalary conidia with truncate ends, terminal conidia rounded apically, not showing frills or disjunctives after release, never grouped in globose slimy heads.

Material studied: IMI 349602 (=FMR 3782), isolated by J. Gené from goat dung, Andraitx, Majorca, Spain, 10 Aug. 1989.

Hormographiella verticillata Guarro, Gené et Guého, **sp. nov.**
(*Etym*: conidiogenous hyphae in verticils) (Figs. 5,6)

Coloniae in agaro farinae avenae ad 25°C celeriter crescunt, 9 cm diametri post 14 dies, albae, planae, floccosae vel velutinae, cum marginibus regularibus, reverso incolorato. Ad 37°C moderatim et irregulariter crescunt. Hyphae hyalinae, septatae, laeves vel verruculosae, 1.5-4(5) μm crassae. Conidiophora macronematosa, nonnumquam semi-macronematosa, mononematosa, 11-145 x 3.5-5 μm, hyalina, brevia, simplicia et non septata vel longa et septata, interdum ramosa, cum apice iterum sympodialiter ramoso, laevia vel modice asperulata. Hyphae conidiogenae discretae, simpliciae, raro ramosae, erectae, 5-18 x 1.5-3 μm, in verticillis lateralis et terminalis, usque ad 8 in numero. Conidia sessilia et simplicia, raro catenata et ramosa, cylindracea, (3)4-15(17) x (1.2)1.5-2(3) μm, laevia vel asperulata, recta vel modice curvata, hyalina, non-septata.

Cultura typica: *ex catheter, in collectione fungorum IMI, Kew, Britannia deposita est.* **Isotypus** FMR 3936.

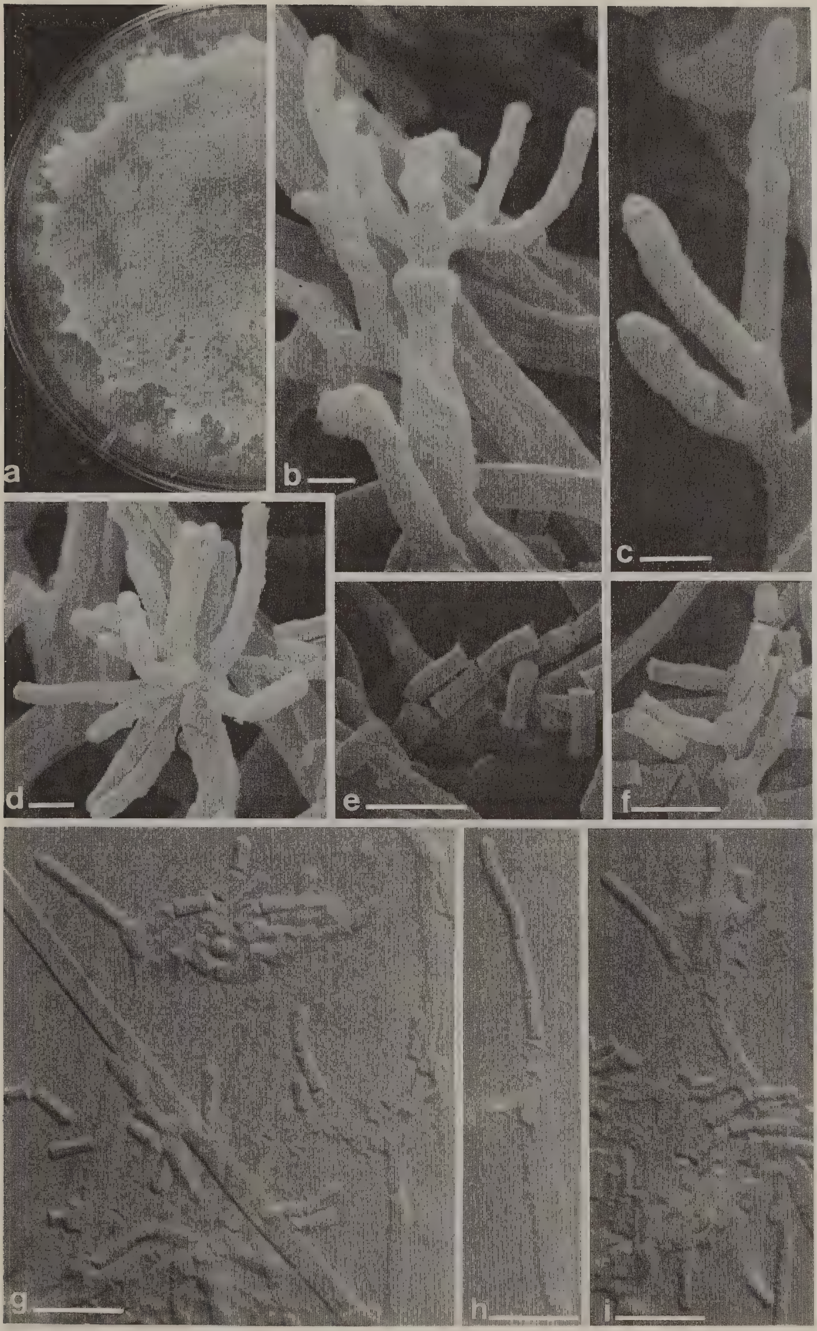
Colonies on OMA at 25°C growing rapidly, reaching 65-70 mm diam. in 7 days and filling the 9 cm Petri-dish in 14 days, white, flat, floccose vel felty, margin regular but diffuse, reverse colourless. At 37°C, colonies slighly more restricted, 30-32 mm diam. in 7 days, white, patchy, sparse, floccose with some raised mycelial tufts, margin irregular, reverse colourless.

Colonies on PYE at 25°C reaching 22-23 mm diam. in 7 days, white, aerial mycelium dense, cottony, margin regular, reverse colourless at the periphery, pale brown at the centre. At 37°C colony growth slower, 6-7 mm diam. in 7 days, white to cream-coloured, cottony, margin irregular and sparse, floccose, reverse pale brown to brown.

The colonies on YpSs at 25°C reaching 20-22 mm diam. in 7 days, white, aerial mycelium scant, downy, with light yellow mycelial tufts, margin regular, reverse colourless. At 37°C colony growth is slower, reaching 8-10 mm diam. in 7 days, white to yellow, downy to fluffy, reverse pale yellow at the centre, colourless at the periphery. Sporulation is very poor in these conditions.

On 2% MEA the colonies reach 64-65 mm diam. in 7 days, filling the 9 cm Petri-dish up to the lid in 14 days, initially white, becoming mottled light yellow to brownish yellow, dense, cottony, margin regular, reverse mottled brown; when dry becoming flattened and felt-like. At 37° colony growth is slower, reach 30-32 mm diam. in 7 days, the rest of the characters being similar to the above.

Fig. 4. ***Hormographiella candelabrata*** (IMI 349602). ***a***, colony morphology after 21 days at 37°C; ***b-d***, conidiophores (*b*,*c* bar=2 μm; *d* bar=5 μm); ***e*,*f***, conidia (bar=5 μm); *g-i*, conidiophores (bar=10 μm).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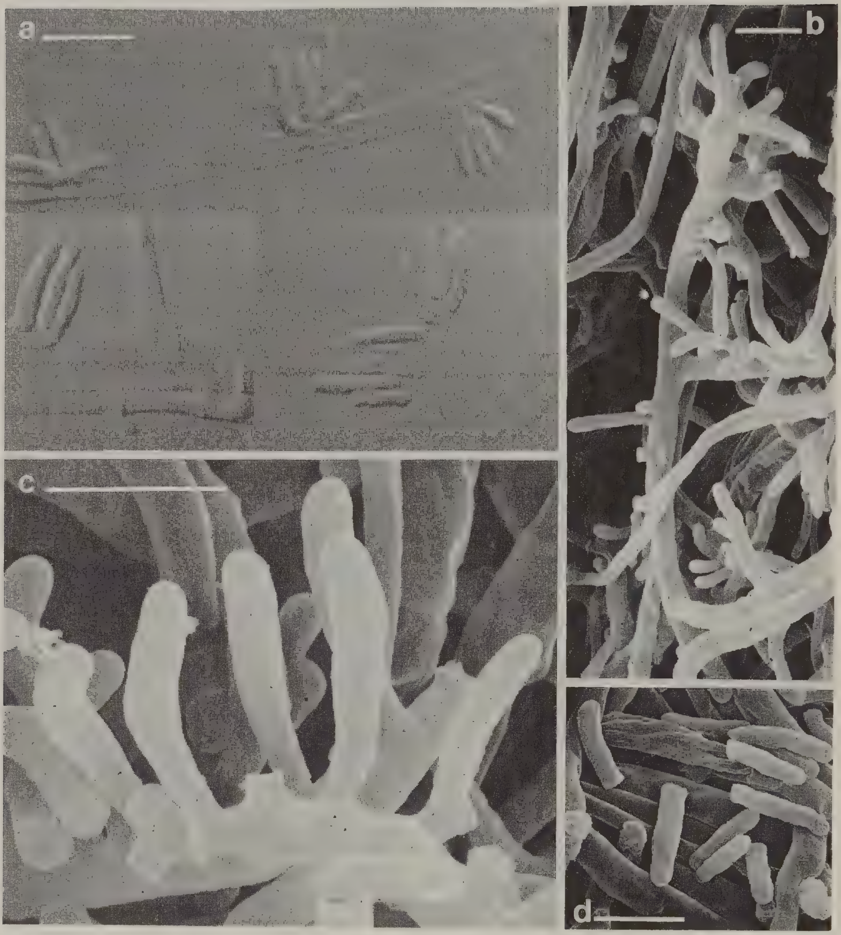

Fig. 5. ***Hormographiella verticillata*** (FMR 3936). *a-c*, conidiophores (***a*** bar=10 μm; ***b,c*** bar=5 μm); *d*, conidia (bar=5 μm).

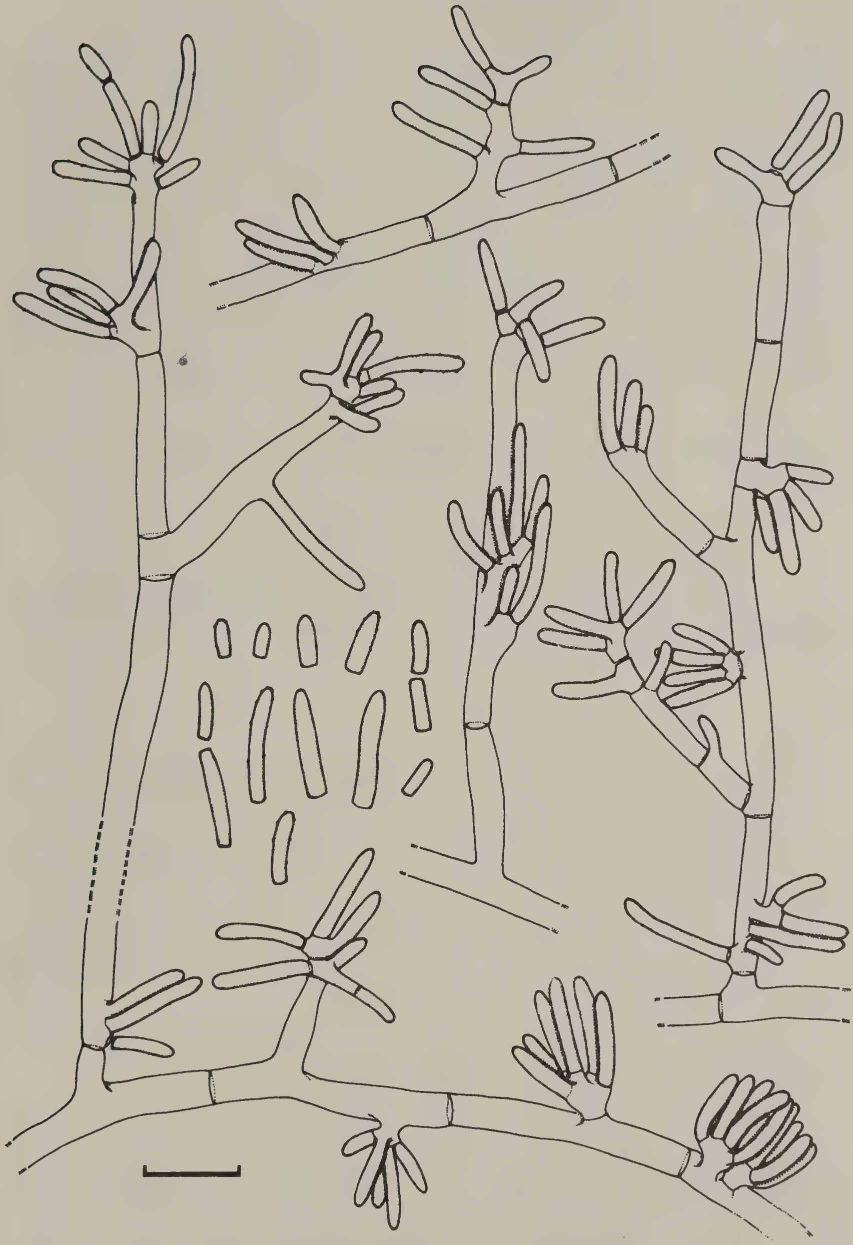

Fig. 6. ***Hormographiella verticillata*** FMR 3936 (bar = 10 μm).

Vegetative hyphae hyaline, septate, smooth or delicately roughened, 1.5-4(5) μm broad. Conidiophores arising from aerial hyphae, macronematous, sometimes semi-macronematous, mononematous, 11-145 x 3.5-5 μm, short, simple and aseptate, with a verticil of conidiogenous hyphae at their swollen apex, or septate and branched, elongating repeatedly by sympodial proliferation, each branch producing a verticil of conidiogenous hyphae intercalarly and apically, up to 8 in number. Conidiogenous hyphae simple, rarely branched, 5-18 x 1.5-3 μm, frequently borne in verticils directly from vegetative hyphae, near the septa, or from inconspicuous conidiophores. Conidia usually simple and sessile, sometimes two conidia in chain, cylindrical, straight or slightly curved, non septate, hyaline, smooth to verrucose, (3)4-15(17) x (1.2)1.5-2(3) μm, terminal conidia rounded apically, intercalary ones with truncate ends, sometimes grouped in globose slimy heads only when on MEA. On this medium the strain presents alterated characteristics in comparison with the rest of the media, the conidia appearing swollen with many vacuoles and coarsely verrucose, especially at the apex.

Material studied: FMR 3936 (=IP 2019.91), isolated by M.A. Piens from a derivative cerebro-spinal fluid catheter, Lyon, France, Mar. 1991.

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NOTES ON THE LOPHIOSTOMATACEAE (PLEOSPORALES)

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SUMMARY

The family Lophiostomataceae includes seven North American genera with the addition of *Entodesmium*. Each genus is briefly discussed and keys to North American species are provided. Seven new species are proposed: *Cilioplea amplispora*, *C. occidentalis*, *Herpotrichia arizonica*, *H. setosa*, *Lophiostoma columbiense*, *Massarina eccentrica*, *M. quinqueseptata*. New combinations include *Cilioplea montana* (Barr) Barr, *C. straminis* (Cooke & Harkness) Barr, *Entodesmium vermisporum* (Ellis) Barr, *Herpotrichia alligata* (Fr.) Barr, *H. decidua* (Ellis & Everh.) Barr, *H. ellisii* (Sacc. & Sydow) Barr, *H. herbarum* (Wehm.) Barr, *Lophiostoma heterosporum* (De Not.) Barr, *L. hyalosporum* (Sacc.) Barr, *Lophiotrema alpinum* (Ellis & Everh.) Barr, *L. velatum* (Ellis & Everh.) Barr, *Massarina albocarnis* (Ellis & Everh.) Barr, *M. arundinariae* (Ellis & Everh.) Barr, *M. canadensis* (Ellis & Everh.) Barr, *M. grumata* (Cooke in Sacc.) Barr, *M. leucosarca* (Ellis & Everh.) Barr, *M. lignorum* (Wehm.) Barr, *M. palmetta* (Cooke) Barr, *M. xerophylli* (Ellis) Barr, *Trichometasphaeria populi* (Ellis & Everh.) Barr. The new name *Lophiotrema neohysterioides* includes the species described separately by Schweinitz and Ellis & Everhart.

The Lophiostomataceae and Massarinaceae were combined as a single family by Barr (1987), after removal of melanommataceous elements. Generally within the family, ascospores are hyaline or light yellowish or reddish brown; they may be one or several septate or muriform, and are often surrounded by a gel coating or bear terminal or lateral appendages. Asci are oblong, cylindric or clavate and have a narrow endotunica. Numerous narrowly cellular pseudoparaphyses in a gel matrix occupy the upper region of the locule and present a characteristic sheetlike aspect. Variations in vestiture and apices of the sphaeroid or globose ascomata also aid in separation of genera.

Dangeardiella is a European genus not yet known from North America. *Lophiotrema* is accepted as separate from *Lophiostoma*, following L. and K. Holm (1988). *Entodesmium* is added to the family, with justification made below. Of the genera assigned to the Lophiostomataceae by O. Eriksson and Hawksworth (1991), *Byssolophis* and *Massariosphaeria* (the latter a synonym of *Chaetomastia)* are better disposed in the Cucurbitariaceae and Dacampiaceae, respectively. *Keissleriella* is recognized as separate from *Trichometasphaeria* and is melanommataceous in Barr's (1990a) concept, as are *Navicella*, *Ostropella* and *Platystomum*. A revised key to North American genera follows.

1. Apex of ascoma composed of or bearing short dark setae, short papillate, rounded conoid........................2
1. Apex of ascoma composed of small darkened cells, papillate, terete or compressed, or obtuse and opening by pore or long slit......................................3
    2. Ascospores transversely septate.................. *Trichometasphaeria*
    2. Ascospores muriform.....................*Ciliopleа*
3. Ascomata erumpent superficial, bearing hyphal or septate-setose appendages and usually gregarious in slight or well-developed subiculum..................*Herpotrichia*
3. Ascomata immersed erumpent, not usually bearing appendages nor in subiculum, separate or gregarious...........4
    4. Apex of ascoma compressed, opening slit-like.....5
    4. Apex of ascoma terete, rarely slightly compressed, opening rounded....................................6
5. Peridium unequal in thickness, narrower below than above; asci clavate or oblong.................*Lophiostoma*
5. Peridium nearly equal in thickness throughout; asci cylindric or oblong..........................*Lophiotrema*
    6. Apex of ascoma short and bluntly papillate; peridium unequal in thickness, narrower below than above; ascospores ellipsoid or fusoid, biseriate in clavate asci...............................*Massarina*
    6. Apex of ascoma forming a definite blackened papilla; peridium nearly equal in thickness throughout; ascospores narrowly fusoid or filiform, biseriate or fasciculate in cylindric or oblong asci...... *Entodesmium*

Ciliоplea includes dictyosporous species whose ascoma apex is composed of or bears short dark setae; species of the genus are related to the phragmosporous species in *Trichometasphaeria* in apical setae but have more septa in the ascospores. Barr (1990b) accepted three North American taxa, *C. coronata* (Niessl) Munk subsp. *montana* Barr, *C. fulgurata* (Ellis & Everh.) Barr, and *C. kansensis* (Ellis &

Everh.) Crivelli. *Cilioplea coronata* (Fig. 1 c) is now known in North America (on *Grindelia integrifolia* DC., CANADA: British Columbia: Sidney, 8 Sep 1991, M. E. Barr 7748, DAOM). The subspecies *montana* is raised to species rank, for the obtusely ended ascospores are consistently wider than those of *C. coronata*. *Leptosphaeria straminis* is transferred into the genus and two undescribed species are added. The species may be separated by the following key.

1. Ascospores mostly obovoid, apex obtuse, tapered to more acute base..2
1. Ascospores fusoid, tapered to acute apex and base.....4
2. Ascospores wide, 18-30 x (7-)9-11(-12.5) µm; in woody twigs...............................*C. montana*
2. Ascospores narrower, 5-8(-9.5) µm...............3
3. Ascospores 12-22 µm long; in fibers of *Populus* wood.... *C. fulgurata*
3. Ascospores 15-24(-28) µm long; in *Melilotus* stems...... *C. kansensis*
4. Ascospores wide, 28-35 x 14-15 µm; in old periderm of *Arbutus*............................*C. amplispora*
4. Ascospores narrower, 5-8 or 9-12 µm.............5
5. Ascospores 25-32(-35) x 9-12 µm; in woody branches..... *C. occidentalis*
5. Ascospores mostly 20-30 x 5-8 µm.....................6
6. Ascospores 20-29 x 5.5-8 µm; in monocot culms and leaves..................................*C. straminis*
6. Ascospores 20-35 x 6-8(-10) µm; in dicot stems.... *C. coronata*

Cilioplea amplispora Barr, sp. nov. Fig. 1 a,b

Ascomata gregaria immersa globosa 400-500 µm diametro, papillae setosae, setae breves, peridium 20-25 µm vel super apicem 40-50 µm. Asci bitunicati cylindrici 200-225 x 20-22 µm. Pseudoparaphyses cellulosae. Ascosporae 28-35 x 14-15 µm brunneae ellipsoideae fusoideae, transversaliter 7-9-septatae et longitudinaliter 1-2-septae. Holotypus in *Arbuti menziesii* Pursh cortice "Canada, British Columbia, Sidney, 25 Jan 1991" a M. E. Barr 7412 lectus in DAOM et NY depositus.

Ascomata gregarious, immersed in crumbling periderm, globose or nearly so, 400-500 µm wide; apex short papillate, 75-100 µm, composed of short, dark, irregular setae; peridium dark brown, pseudoparenchymatous cells, 20-25 µm wide at base and sides, thickened above to 40-50 µm, hyphae below. Asci 200-225 x 20-22 µm. Pseudoparaphyses narrowly cellular. Ascospores 28-35 x 14-15 µm, brown, ellipsoid fusoid, tapering to acute ends, 7-9-septate, slightly constricted at first-formed septum, one or two (three) longitudinal septa; wall smooth; homogeneous; uniseriate in the ascus.

In old periderm on twigs of *Arbutus menziesii*.

Additional collection examined. British Columbia: Sidney, 29 Apr 1991, 7539 (DAOM).

This taxon has much in common with *C. nivalis* (Niessl) Crivelli, which develops in herbaceous stems in the Swiss Alps. The ascomata in both species are large and globose and asci are nearly cylindric rather than clavate. *Ciliopleа amplispora* has even wider ascospores than does *C. nivalis*, where they are 24-35 x 9.5-12 µm (Crivelli 1983).

Cilioplea montana (Barr) Barr, comb. nov.

Cilioplea coronata (Niessl) Munk subsp. *montana* Barr, Mem. New York Bot. Garden 62: 56. 1990.

This North American taxon on woody branches has wider, obtusely ended and usually darker ascospores than does *C. coronata*.

Cilioplea occidentalis Barr, sp. nov. Fig. 1 d,e

Ascomata gregaria immersa sphaeroidea 200-400 µm lata 200-300 µm alta, papilla setosa, setae breves vel 40 µm longae, peridium 10-20 µm vel super apicem 25 µm. Asci bitunicati clavati 90-135 x 18-22 µm. Pseudoparaphyses cellulosae. Ascosporae 25-32(-35) x 9-12 µm hyalinae vel ochraceae fusoideae, transversaliter 5-7-9-septatae et longitudinaliter 1-(2-)septatae. Holotypus in *Lonicerae involucratae* (Richardson) Banks ex Spreng. caulae "Canada, British Columbia, Sidney, 1 Apr 1991" a M. E. Barr 7496 lectus in DAOM et NY depositus.

Ascomata gregarious, immersed, at times in reddened areas of branch, sphaeroid, 200-400 µm wide, 200-300 µm high; apex short papillate, covered by protruding cells or short dark setae up to 40 µm long; peridium narrow, small pseudoparenchymatous cells, reddish brown, ca. 10-20 µm wide, darker and up to 25 µm over papilla, reddish brown hyphae into substrate. Asci 90-135 x 18-22 µm, numerous. Pseudoparaphyses narrow cellular. Ascospores 25-32(-35) x 9-12 µm, hyaline, soon light yellowish brown, fusoid, often curved, 5-7-9-septate, constricted at first- and second-formed septa, one (two) longitudinal septum in all but end cells; wall smooth, surrounded by narrow gel coating; one or more globules in each cell; biseriate in the ascus.

In branches.

Additional collection examined: British Columbia: *Grindelia integrifolia*, Sidney, 2 Aug 1991, M. E. Barr 7690 (DAOM).

The setae of *C. occidentalis* are reduced to protruding cells over the apex of small ascomata in the type collection, but reach 40 µm in the later collection. The ascospores are similar in shape to those of *C. coronata* although they are somewhat wider.

Cilioplea straminis (Cooke & Harkness) Barr, comb. nov.

Leptosphaeria straminis Cooke & Harkness, Grevillea

14: 10. 1885.

Catharinia straminis (Cooke & Harkness) Berlese, Icon. Fung. 2: 101. 1897.

Pleospora harknessii Berlese & Voglino, Addit. Syll. Fung. 1-4: 174. 1886.

Shoemaker and Babcock (1989) redescribed this grass-inhabiting species as *Pleospora harknessii*. *Massarina graminicola* Mundkar & Ahmad (Mycol. Pap. 18: 4. 1946), *Catharinia graminicola* (Mundkar & Ahmad) Wehm. & Ahmad (Biologia 10: 7. 1964), *Julella graminicola* (Mundkar & Ahmad) Ahmad (Monogr. Biol. Soc. Pakistan 8: 79. 1978), and *Catharinia cynodontis* Müller & Ahmad (Biologia 3: 3. 1957) are evidently closely related and could be identical to *C. straminis*.

Entodesmium. The genus was redescribed with six species by L. Holm (1957) and Shoemaker (1984b), to include taxa on leguminous stems, having immersed, dark short to long-beaked ascomata, thin peridium of small pseudoparenchymatous cells, periphysate ostioles, numerous asci in narrowly cellular pseudoparaphyses, pale yellow to light yellowish brown, four or more septate ascospores, narrowly fusoid to filiform, the first-formed septum supramedian. Short pulvinate to globose appendages are present in some species and/or a lateral appendage near first septum. Shoemaker (1984b) reported the species only from Europe, although Wehmeyer (1952) had identified some collections from Mt. Rainier, Washington as *Leptosphaeria niessleana* Rabenh. A collection on *Lathyrus latifolius* L. (CANADA: British Columbia: Sidney, 20 Jun 1990, M.E. Barr 7189, DAOM) of *E. niessleanum* (Rabenh. ex Niessl) L. Holm, confirms the presence of the genus in North America (Fig. 1 f).

The position of this genus in the Loculoascomycetes has not been clear. Von Arx and Müller (1975) assigned it to the Pleosporaceae in the wide sense and O. Eriksson and Hawksworth (1991) to the Phaeosphaeriaceae. The short, blackish beak with periphysate ostiole is more indicative of the Lophiostomataceae. Members of the genus differ from species of *Trichometasphaeria* in narrowly fusoid to filiform ascospores that lack a wide hyaline coating but often possess appendages, and in the nonsetose ascoma apex.

Lophionema vermispora (Ellis) Sacc., the type species of that genus, scarcely differs from species of *Entodesmium*. The ascomata are nearly globose and have a well-developed, terete or compressed apical beaklike papilla. The peridium, of small pseudoparenchymatous cells, is thick and blackened in the apical region, thinner and paler in the body of ascoma. Pseudoparaphyses are numerous, narrowly cellular, asci nearly cylindric, and ascospores hyaline to pale yellowish, seven septate, slightly constricted at second or third septum, filiform, slightly tapered to base, with a short pulvinate appendage at each end. The genus was described as a member of the Lophiostomataceae (Saccardo 1883) and Berlese (1890) included it in that family; he noted also that it was close to *Ophiobolus* because of the variable apex. Chesters and Bell (1970) redescribed *Lophiostoma vermisporum* and questioned the necessity for a separate genus; if further study proved it was not a species of *Ophiobolus*, they believed the species should remain in *Lophiostoma* despite the very different ascospores. Shoemaker (1976) made the transfer to *Ophiobolus* in his study where that genus was given a wide circumscription. *Lophionema vermisporum* differs from *Ophiobolus* in the narrow sense (L. Holm, 1957). *Ophiobolus* is arranged in the Leptosphaeriaceae (Barr 1987), where *L. vermisporum* certainly does not belong. Neither is it appropriate in *Nodulosphaeria*. Whether apices are terete or flattened, the peridium structure, i.e., small, more or less compressed, darkened cells, is lophiostomataceous. The hyaline or slightly yellowish ascospores have terminal appendages, the first-formed septum is supramedian and the cell above this is slightly enlarged. Such ascospores are typical of species of *Entodesmium*, and the following combination is proposed:

Entodesmium vermisporum (Ellis) Barr, comb. nov. Fig. 1 g
- *Lophiostoma vermisporum* Ellis, Bull. Torrey Bot. Club 9: 19. 1882.
- *Lophionema vermisporum* (Ellis) Sacc. Syll. Fung. 2: 717. 1883.
- *Lophiosphaera vermispora* (Ellis) Cooke, Grevillea 17: 26. 1888.
- *Ophiobolus vermisporus* (Ellis) Shoemaker, Canad. J. Bot. 54: 2393. 1976.

Collections examined: stems of *Oenothera biennis* L., USA: New Jersey: Newfield, 7 Aug 1881, J. B. Ellis (holotype); N.A.F. 885 (isotype) (both NY). Although the host plant differs from the leguminous hosts of other species in the genus, such host restriction cannot be maintained as the sole characteristic of a genus.

Herpotrichia. Some changes and additions are made to *Herpotrichia*. Three of the species described and illustrated by Barr (1984) are retained in the genus: *H. herpotrichoides* (Fuckel) Cannon, *H. juniperi* (Duby) Petrak, *H. macrotricha* (Berk. & Broome) Sacc. *Herpotrichia symphoricarpi* is redisposed to *Dothidotthia* under *D. lasioderma* (Ellis & Everh.) Barr, the earlier name (Barr 1989b). One Friesian species and three additional new combinations are proposed and with two new species enlarge the genus. A revised key to species follows.

1. Ascomata medium sized, obpyriform, apex well developed, caplike...2

1. Ascomata medium or small sized, sphaeroid or globose, apex rounded, plane or short papillate....................3
   2. Ascospores (21-)24-43 x (4-)5-7.5 µm.............. H. *macrotricha*
   2. Ascospores (12-)14-18 x 4-5(-6) µm......*H. ellisii*

3. Ascospores 10-14 x 5-6 µm, mostly 2-septate, ends obtuse.. *H. arizonica*
3. Ascospores longer, 1-3-septate, ends obtuse or acute..4
   4. Ascomata small sized, hyphae setose over much of peridium; ascospores 17.5-24 x 7.5-9 µm.....*H. setosa*
   4. Ascomata medium sized, hyphae not setose.........5
5. Ascospores 15-18 x 3-3.5(-4) µm; subiculum sparse, basal...*H. decidua*
5. Ascospores wider; subiculum usually well developed....6
   6. Ascospores 17-23 x (4-)5-7 µm..........*H. alligata*
   6. Ascospores 18-35(-40) µm long....................7
7. Ascomata numerous in strongly developed subiculum on conifer leaves and branches...................*H. juniperi*
7. Ascomata scattered or gregarious in less developed subiculum on leaves, twigs, herbaceous stems............8
   8. Ascomata opening by rounded pore; ascospores 18-27(-32) x 5-8 µm...................*H. herpotrichoides*
   8. Ascomata opening by rounded pore or long slit; ascospores 26-35(-40) x 5-7.5(-10) µm.....*H. herbarum*

Herpotrichia alligata (Fr.) Barr, comb. nov. Fig. 1 h,i
Sphaeria alligata Fr. Syst. Mycol. 2: 445. 1823.
Eriosphaeria alligata (Fr.) Sacc. Syll. Fung. 1: 599. 1882.

Ascomata immersed, then erumpent to superficial, gregarious in rounded patches or long rows of brown subiculum, sphaeroid, 440-550 µm wide, 330-385 µm high; apex rounded, papilla short; peridium ca. 30 µm wide, of reddish brown, somewhat compressed cells. Asci 90-140 x 10-12 µm, cylindric. Pseudoparaphyses numerous, narrowly cellular, sheetlike in gel matrix above asci. Ascospores 17-23 x 5-7 µm, hyaline to light brownish in age, ellipsoid, 1-(3-)septate; wall smooth, narrow gel coating.

On old branches.

Collections examined. SWEDEN: Scler. Suec. 348, E. Fries (isotype, FH). USA: Texas: *Opuntia*, Brewster Co., Apr 1987, M. & P. Rohman (NY, with *Coniochaeta cf. ovalis*).

The North American specimen agrees well with the Swedish one. When ascomata are immersed the subiculum is less pronounced and one could search in *Massarina* for this species.

Herpotrichia arizonica Barr, sp. nov. Fig. 1 j,k

Ascomata gregaria erumpentia superficialia sphaeroidea 220-385 µm lata 190-250 µm alta, papilla brevis, peridium 15-30 µm, hyphae basales brunneae. Asci bitunicati cylindrici 70-92 x 7-9 µm. Pseudoparaphyses cellulosae. Ascosporae 10-14 x 5-6 µm ochraceae obovoideae (1-)2-(3-)septatae. Holotypus et paratypus in *Carnegieae giganteae* (Engelm.) Britton & J. Rose ligno "USA, Arizona, Picacho Peak State Park, Pinal Co., 4 Jun 1978," a R. Halling lectus (holotype); "Saguaro Nat'l Monument, East Unit, Tucson, Pima Co., 17 Aug 1980," a R. L. Gilbertson et M. Blackwell lecti (paratypus) in NY depositus.

Ascomata usually gregarious, often in long rows, erumpent superficial, sphaeroid, 220-385 µm wide, 190-250 µm high; apex rounded, papilla short; peridium reddish brown, 15-30 µm wide, of small pseudoparenchymatous cells, clothed with brown hyphae especially below. Asci 70-92 x 7-9 µm, cylindric, 4- or 8-spored. Pseudoparaphyses narrowly cellular, 1.5-2 µm wide. Ascospores 10-14 x 5-6 µm, light brown, obovoid, ends obtuse, (1-)2-(3-)septate, first-formed septum submedian, constricted; wall verruculose; contents guttulate; obliquely uniseriate in the ascus.

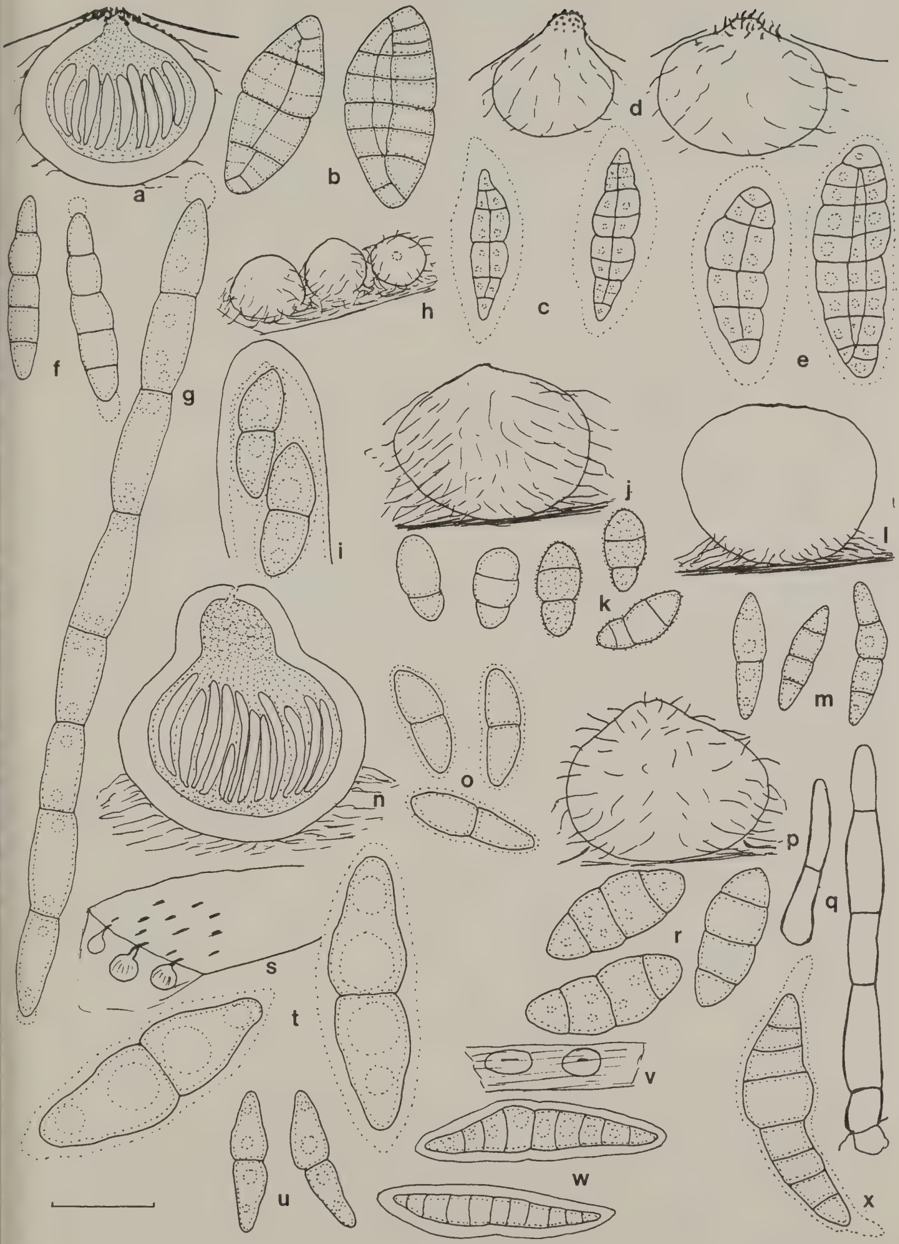
On old decorticated saguaro, *Carnegiea gigantea*, Arizona. Known from the type collections.

The small, obovoid ascospores have unusual septation for *Herpotrichia*, although the species fits well in the genus. These collections differ from that on *Opuntia* noted above under *H. alligata* in both size and septation of ascospores.

Herpotrichia decidua (Ellis & Everh.) Barr, comb. nov.
Fig.1 l,m
Melanomma deciduum Ellis & Everh. Proc. Acad. Nat. Sci. Philadelphia 45: 445. 1893.

Ascomata separate or few gregarious, erumpent superficial from wood fibers, sphaeroid, 275-330 µm wide, 220-275 µm high, papilla minute; peridium 40-50 µm wide, dark reddish brown slightly compressed cells, dark hyphae from lower sides and base. Asci 50-60 x 7-7.5 µm, oblong. Pseudoparaphyses numerous, narrowly cellular, 2-2.5 µm wide. Ascospores 15-18 x 3-3.5(-4) µm, light brown,

Fig. 1. a, b. *Cilioplea amplispora*, a, ascoma in vertical view, b, ascospores. c. *C. coronata*, ascospores. d, e. *C. occidentalis*, d, ascomata in vertical view, e, ascospores. f. *Entodesmium niessleanum*, ascospores. g. *E. vermisporum*, ascospore. h, i. *Herpotrichia alligata*, h, habit of ascomata, i, ascus apex and ascospores. j, k. *H. arizonica*, j, ascoma in vertical view, k, ascospores. l, m. *H. decidua*, l, ascoma in vertical view, m, ascospores. n, o. *H. ellisii*, n, ascoma in vertical view, o, ascospores. p-r. *H. setosa*, p, ascoma, q, setae, r, ascospores. s, t. *Lophiostoma columbiense*, s, habit, t, ascospores. u. *L. floridanum*, ascospores. v, w. *L. hyalosporum*, v, habit, w, ascospores. x. *L. winteri*, ascospore. Standard line = 15 µm for ascospores, 150 µm for ascomata. Habit sketches not to scale.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fusoid, 1-3-septate, septa darker than walls or contents, constricted slightly at first-formed septum; wall smooth.

On old wood.

Collections examined. USA: New York: black ash railroad ties, Potsdam, 1 Jun 1860 (syntype); cedar rail, Potsdam, 9 Mar 1862 (syntype). Kansas: weathered pine lumber, Rooks Co., 3 Jul 1895, E. Bartholomew, Kansas Fungi 1738, two packets (all NY).

The scanty basal subiculum might suggest *Massarina*, but the ascomata are erumpent superficial rather than immersed, and the ascospores are lightly pigmented at an early stage in development.

Herpotrichia ellisii (Sacc. & Sydow) Barr, comb. nov.
Fig. 1 n,o

Melanopsamma ellisii Sacc. & Sydow, Syll. Fung. 14: 540. 1899.

Melanopsamma borealis Ellis & Everh. Proc. Acad. Nat. Sci. Philadelphia 45: 445. 1893 (1894), non (Karsten) Sacc. 1882.

Melanopsamma waghornei House, Bull. New York State Mus. 179: 37. 1915.

Ascomata gregarious to crowded, erumpent superficial from wood fibers, sphaeroid, 275-385 µm wide, 275-330 µm high; papilla up to 150 um wide and high, somewhat puckered and irregular, pore area reddish; peridium up to 40 µm wide, dark reddish brown externally, pallid internally, dark hyphae at lower sides as thin subiculum and into substrate. Asci 90-115 x 8-10 µm, cylindric. Pseudoparaphyses narrowly cellular, in gel matrix. Ascospores (12-)14-18 x 4-5(-6) µm, hyaline, ellipsoid, ends obtuse, 1-septate, not or slightly constricted; wall smooth; uniseriate in the ascus.

In loosened inner periderm of fir *(Abies)*.

Collections examined. CANADA: Newfoundland: Bay Bull's Arm, 29 May 1893, A. C. Waghorne (holotype); 19 or 29 Mar 1893; Waghorne 95 (all NY).

This species was redescribed by Ellis and Everhart in 1895 (Proc. Acad. Nat. Sci. Philadelphia 47: 416) and 1897 (Bull. Torrey Bot. Club 24: 459), with only minor changes in measurements. The ascomatal apex was described as "...irregularly cleft and torn so as to resemble the blossom end of an apple." In side view, ascomata resemble those of *H. macrotricha* although the subiculum is less conspicuous. Asci and ascospores are similar to those in *H. alligata*.

Herpotrichia herbarum (Wehmeyer) Barr, comb. nov.

Eriosphaeria herbarum Wehmeyer, Sydowia 6: 418. 1952.

Lophiostoma herbarum (Wehmeyer) Shoemaker & Babcock, Canad. J. Bot. 65: 389. 1987.

This species was transferred to *Lophiostoma* by Shoemaker and Babcock (1987) who provided a full description and illustrations. On re-examination of specimens, I agree that the fungus is indeed a member of the Lophiostomataceae rather than the Pseudosphaeriaceae, but the small apex may be rounded or compressed, and vestiture of ascomata is most conspicuous, leading to disposition under *Herpotrichia*. The taxon on *Gentiana calycosa* Griseb. that they described as *Lophiostoma* species 1 may well be identical. My original notes and drawings of *Wettsteinina gentianae* (Wehmeyer) Barr, on the same stems, match well that species, even though Shoemaker and Babcock did not relocate the fungus. As they observed, several fungi are present on the stems.

Herpotrichia setosa Barr, sp. nov. Fig. 1 p-r

Ascomata solitaria vel gregaria erumpentia superficialis sphaeroidea 130-250 µm lata 100-200 µm alta, papilla brevis, peridium 12-16 µm, setae brunneae septatae 20-55 x 5.5-6.5 µm. Asci bitunicati oblongi 60-80 x 13-16.5 µm. Pseudoparaphyses cellulosae. Ascosporae 17.5-24 x 7.5-9 µm ochraceae ellipsoideae 3-septatae. Holotypus in *Betulae glandulosae* Michx. amentorum, "Canada, Newfoundland, Labrador, near Bear Cove Pond, 2 Jul 1957," a R. T. Wilce lectus in NY depositus.

Ascomata scattered to gregarious, erumpent to superficial, sphaeroid, 130-250 µm wide, 100-200 µm high; apex rounded, short papillate; peridium 12-16 µm wide, cells somewhat compressed, surface of radiating rows of cells from apex downward, covered with short, septate, dark brown setae, 20-55 x 5.5-6.5 µm, over upper two-thirds, brown hyphae forming thin subiculum below. Asci 60-80 x 13-16.5 µm, broadly oblong. Pseudoparaphyses numerous, narrowly cellular. Ascospores 17.5-24 x 7.5-9 µm, yellowish brown, ellipsoid, straight to inequilateral or slightly curved, 3-septate, usually constricted at median septum; wall smooth; overlapping biseriate in the ascus.

On old aments.

Additional collection examined. EIRE: Gougane Barra, *Myrica gale* L., 19 Aug, O. Degener ex MASS 22436 (NY).

This species is similar to *H. juniperi* in ascospores, but the ascomata bear short setose appendages and the subiculum is sparse.

Lophiostoma. Studies on *Lophiostoma* in recent times (Chesters and Bell 1970, L. and K. Holm 1988) have expanded knowledge and refined understanding of the species. The species that have pleosporaceous centra and compressed, conspicuous apices or low obtuse apices bearing a long slit are arranged here or in *Lophiotrema*, following L. and K. Holm (1988). Other *Lophiostoma*-like taxa that have melanommataceous centra should be sought in *Ostropella*, *Platystomum*, *Navicella*, or in *Thyridaria* where most species have a terete papillate apex (Barr 1990a). *Byssolophis*, on the other hand, seems better accommodated in the Cucurbitariaceae.

Some species that have hyaline, several-septate ascospores with a firm rather wide hyaline wall pose other problems. They have resided uneasily in several genera: *Metasphaeria, Leptosphaeria, Lophiotrema* originally, more recently in *Trichometasphaeria [T. scirpina* (Winter) L. Holm 1957], *Massariosphaeria [M. grandispora* (Sacc.) Leuchtmann 1984 typically on monocots, *M. alpigena* (Fuckel) K. & L. Holm 1988, on woody branches] or *Lophiotrema [L. grandispora* (Sacc.) Shoemaker & Babcock 1989]. *Massariosphaeria* is typified by the brown, phragmosporous *M. phaeospora* (Müller) Crivelli (1983) and is included as a synonym of *Chaetomastia* (Dacampiaceae) by Barr (1989a). Taxa having hyaline, thick-walled ascospores do not belong in the concept of *Chaetomastia*. Although the hyaline-spored species mentioned above are European as far as is known, two similar but separable North American taxa are involved, *Metasphaeria hyalospora* (Sacc.) Sacc. and *Lophiostoma spiraeae* Peck. The peridium, narrow toward the base and thickened and dark in upper regions, and the clavate asci indicate that these taxa belong in *Lophiostoma* rather than in *Lophiotrema*. *Lophiostoma spiraeae* evidently is related to the European *L. massarioides* Sacc. and to *L. alpigenum* Fuckel, and differs from these taxa in consistently narrower ascospores. *Metasphaeria hyalospora* has oblong ascomata with a very short compressed papilla, much as in *Metasphaeria grandispora* (Sacc.) Sacc., and has smaller, less septate ascospores. These North American species are assigned to *Lophiostoma* in the present study. A key to separate the North American species follows.

1. Ascospores up to 20 µm long, 1-septate...............2
1. Ascospores mostly 20 µm or longer, 1- or several-septate...3
2. Ascospores hyaline, (12-)15-20 x 3-5 µm, appendaged; ascomata small, 130-275 µm wide, apex papillate and compressed................*L. fuckelii*
2. Ascospores light brown, 18-20 x 3.5-5 µm, not appendaged; ascomata medium sized, 330-385 µm wide, apex obtuse, opening by long slit.......*L. floridanum*
3. Ascospores hyaline, 8-11-septate, wall firm and thick, not appendaged; ascomata medium or large sized, apex papillate and compressed or low with slit................4
3. Ascospores hyaline or brown, 1-7-septate, wall narrow, appendaged or not; ascomata medium sized, apex papillate and compressed...5
4. Ascospores 27-35 x 5-6 µm; ascomata rounded or ellipsoid, 275-400 µm wide, apex obtuse, opening by low slit................................*L. hyalosporum*
4. Ascospores 40-52 x 5-6 µm; ascomata large, up to 770 µm, apex papillate and compressed....*L. spiraeae*
5. Ascospores brown in the ascus, (17-)20-32(-36) x 5-10 µm, (3-)5-7-septate, usually appendaged; herbs and woody substrates......................................*L. caulium*

5. Ascospores hyaline, becoming light brown in age, 1-7-septate, appendaged or not.............................6
6. Ascospores (6-)8-12.5 µm wide....................7
6. Ascospores (3-)4-7.5 µm wide....................9
7. Ascospores (3-)5-7-septate, (22-)26-34(-40) x (6-)8-11 µm, appendaged; in dwarf shrubs................*L. winteri*
7. Ascospores 1-(3-)septate, 28-40 µm long, not appendaged 8
8. Ascomata immersed in wood; ascospores 28-40 x 8-11 µm....................................*L. columbiense*
8. Ascomata erumpent from rhizomes, culms; ascospores 30-38 x 8-12.5 µm.......................*L. heterosporum*
9. Ascospores (18-)24-37.5 x (3-)4-7.5 µm, 3-5-septate, not appended............................*L. myriocarpum*
9. Ascospores (16.5-)20-33(-38) x 5-7 µm, 1-(3-5-)septate, usually appendaged...............................10
10. Ascospores 25-33(-38) x 5-7 µm; mostly in wood... *L. macrostomum*
10. Ascospores (16.5-)20-25 x 5-6(-6.5) µm; in herbs and wood...........................L. *scrophulariae*

Lophiostoma caulium (Fr.) Ces. & de Not. occurs commonly on herbaceous stems and is also found on woody substrates, rarely on monocots. Chesters and Bell (1970) held a broad concept of the species, as did L. and K. Holm (1988) who recognized five unnamed varieties. Most collections have appendaged ascospores but some lack appendages.

Lophiostoma columbiense Barr, sp. nov. Fig. 1 s,t

Ascomata gregaria immersa globosa 250-450 µm diametro, papilla nigra compressa vel 200 µm alta 30 µm lata, peridium pallida vel brunneae vel 50 µm. Asci bitunicati clavati (80-)100-150 x 16-20 µm. Pseudoparaphyses cellulosae. Ascosporae 28-40 x 8-11 µm hyalinae vel ochraceae fusoideae 1-septatae. Holotypus in *Holodisci discoloris* (Pursh) Maxim. ligno, "Canada, British Columbia, Sidney, 25 Dec 1991" a M. E. Barr 7913 lectus, paratypus in *Grindeliae integrifoliae* ligno, "Canada, British Columbia, Sidney, 2 Aug 1991" a M. E. Barr 7689 lectus in DAOM et NY depositus.

Ascomata gregarious, immersed with slot-like apex visible at surface, globose, 250-450 µm diam; apex compressed, up to 200 µm high, 30 µm in end view, ostiole periphysate; peridium of small pseudoparenchymatous cells, pallid to brown in body, up to 50 µm wide, blackened over papillae. Asci (80-)100-150 x 16-20 µm, clavate. Pseudoparaphyses narrowly cellular, numerous. Ascospores 28-40 x 8-11 µm, hyaline, light brown in age, fusoid, 1-septate, constricted at septum and in each hemispore; wall smooth, verruculose after discharge, surrounded by gel coating; 2-3 globules per cell; overlapping biseriate to triseriate in the ascus.

In decorticated wood. Known from the type collections.

These collections have no counterparts in the studies by Chesters and Bell (1970) and L. and K. Holm (1988). The species appears to be closest to *L. beckhausii* Nitschke in Lehmann, sensu Berlese (1890) but not Lehmann. *Lophiotrema littorale* Speg. also bears resemblances, and it was tempting to allocate these specimens found on the beach of Saanich Inlet to that species. However, those ascospores are wider and five septate.

Lophiostoma floridanum Ellis & Everh. (J. Mycol. 2: 340. 1886) is hyperbiotrophic having ascomata erumpent from stromata of *Graphostroma platystoma* (Schwein.) Piroz. (given as *Diatrype stigma* on label), that have an obtuse apex and inconspicuous long slit. Asci are 60-75 x 10-14 µm; ascospores 18-20 x 3.5-5 µm, 1-septate, constricted, lacking appendages (Fig. 1 u). The syntypes are from USA: Florida: no locality given, Jan 1886, W. W. Calkins 123 and 147 (NY). *Navicella floridana* (Ellis & Everh.) Kuntze, Rev. Gen. Pl. 3: 500. 1898 is a synonymous name.

Lophiostoma fuckelii Sacc. is a species with small, one-septate, appendaged ascospores. It has a long synonymy according to L. and K. Holm (1988) and is most common on *Rubus* stems. Several North American collections are on *Rubus*; additionally, in eastern North America twigs of various trees and shrubs (*Acer, Carpinus, Carya, Platanus, Quercus, Rhus, Salix, Viburnum*) and stems of *Epilobium* also host the species; in western North America it has been found on *Arbutus*. Dead overwintered leaves (*Fagus, Liquidambar, Platanus, Populus, Quercus, Rhododendron*) provide another set of substrates and the fungus on these leaves fits precisely into the description.

Lophiotrema oenotherae Ellis & Everh. [Bull. Torrey Bot. Club 24: 128. 1897); *Lophiostoma oenotherae* Ellis & Everh. nom. nud. N.A.F. 3424; *Lophiotrema vagabundum* f. *oenotherae* (Ellis & Everh.) Rehm, Ann. Mycol. 9: 97. 1911; *Lophiostoma hysterioides* var. *oenotherae* (Ellis & Everh.) Chesters & Bell, Mycol. Pap. 120: 14. 1970] is identical. *Sphaeria gallophila* Ellis [Bull. Torrey Bot. Club 8: 90. 1881; *Diaporthe gallophila* (Ellis) Sacc., Syll. Fung. 1: 667. 1882], should also be added to synonymy of *L. fuckelii*. The holotype material is hyperbiotrophic in old gnomoniaceous ascomata [*Gnomonia rostellata* (Fr.) Wehm., according to Wehmeyer 1933] on *Rubus villosus* Aiton, USA: Newfield, New Jersey, 23 Sep 1879 (NY). Ascospore shape and sizes are much as in those of *G. rostellata* although the asci are bitunicate and eight spored and the peridia differ. Slightly larger ascospores in *L. pulveraceum* Sacc. led Chesters and Bell (1970) to propose a separate variety *pulveracea* (Sacc.) Chesters & Bell, to include also *Lophiostoma heterostomum* Ellis & Everh. [J. Mycol. 2:99. 1886; *Lophiosphaera heterostoma* (Ellis & Everh.) Berlese & Voglino, Syll. Fung. Addit. 425. 1886] but such separation seems unnecessary (L. and K. Holm 1988).

Lophiostoma heterosporum (De Not.) Barr, comb. nov.
Sphaeria heterospora De Notaris, Sferiacei Italici 65. 1863.

This species, on *Iris* rhizomes, has been assigned historically as *Leptosphaeria heterospora* (De Not.) Niessl, *Byssothecium heterospora* (De Not.) Niessl, *Trematosphaeria heterospora* (De Not.) Winter. Boise (1985a) in her revision of *Trematosphaeria*, transferred the species to *Phaeosphaeria*, provided synonymy, description and illustrations of both the teleomorph and a microconidial anamorph. Apices of ascomata are well developed and beaklike, quite compressed and blackened. Shoemaker and Babcock (1989) excluded the species from *Phaeosphaeria* and indicated that it showed affinities with *Lophiostoma*. The species has wide ascospores whose ends are usually pallid, and seems best arranged in *Lophiostoma*. A collection in stem bases of *Typha latifolia* L. (USA: Massachusetts: Franklin Co., Conway, Graves Road, 26 Sep 1982, M. E. Barr 6902, NY) is similar to those on *Iris* rhizomes, although the ascospores are not pigmented.

Lophiostoma hyalosporum (Sacc.) Barr, comb. nov.
Fig. 1 v,w
Leptosphaeria hyalospora Sacc. Fungi Venet. Ser. II. 323; Nuovo Giorn. Bot. Ital. 7: 323. 1875.
Metasphaeria hyalospora (Sacc.) Sacc. Syll. Fung. 2: 179. 1883.

Ascomata gregarious, immersed in substrate, rounded or ellipsoid, sphaeroid, 275-440 µm wide, 220-275 µm high; apex obtuse, papilla very short, compressed; peridium of small reddish brown, pseudoparenchymatous cells, 20-25 µm wide at base, thickened and darker above to 40-50 µm wide. Asci 70-110 x 15-23 µm. Pseudoparaphyses narrowly cellular. Ascospores 27-35 x 5-6 µm, hyaline, fusoid, often inequilateral to curved, 8-10-septate, constricted at most septa, cell above median first-formed septum enlarged; wall thick and firm, 2-3 µm wide; one globule per cell; overlapping biseriate in the ascus.

In old culms of *Zea mays* L.

Collection examined. USA: New Jersey: Newfield, Mar 1879, Ellis N.A.F. 587 (NY).

This is one of the "hyaline-spored *Massariosphaeria*" taxa that was mentioned previously. It is much like *Metasphaeria grandispora* (Sacc.) Sacc., but has shorter and especially narrower ascospores.

Lophiostoma macrostomum (Tode: Fr.) Ces. & de Not., the type species of the genus, normally inhabits wood or periderm but may occur on herbs; the species was redescribed by L. & K. Holm (1988) who included several synonymous names, among them *L. angustilabrum* (Berk. &

Broome) Cooke and *L.* crenatum (Pers.: Fr.) Fuckel.

Lophiostoma myriocarpum Fuckel is a taxon having narrow ascospores, described by L. and K. Holm (1988) on woody substrates and as a variant on old woody stems of *Dryas octopetala L.* The species is known to me by a collection on *Dryas integrifolia* Vahl (CANADA: Northwest Territories: Baffin Island, head of Clyde Inlet, 24 Jun 1950, P. Dansereau 5006240151e, NY).

Lophiostoma scrophulariae Peck is closely related to *L. macrostomum.* Earlier (Barr et al. 1986) the two species were considered to be identical. However, sizes differ consistently and they are now recognized as a separate species. Several synonymous names are known for *L. scrophulariae. Lophiostoma stenostomum* Ellis & Everh. [Bull. Torrey Bot. Club 10: 89. 1883; *Navicella stenostoma* (Ellis & Everh.) Kuntze, Rev. Gen. Pl. 3: 500. 1898] on *Vitis* is one such, seen from N.A.F. 1345, USA: New Jersey: Newfield, Feb 1884; Fungi Col. 2039, CANADA: Ontario: London, Aug 1904, J. Dearness (both NY). *Lophiostoma radicans* Ellis & Everh. [J. Mycol. 3: 44. 1897; *Lophiotrema vagabundum var. radicans* (Ellis & Everh.) Berlese, Icon. Pyrenomyc. 1: 5. 1890; *Lophiotrema radicans* (Ellis & Everh.) Sacc., Syll. Fung. 9: 1077. 1891] on *Rhus radicans* L. is another (N.A.F. 1795, USA: New Jersey: Newfield, July 1878, NY). *Lophiostoma meridionale* Ellis & Everh. (J. Mycol. 4: 76. 1888) (USA: Louisiana: ? *Xanthium*, St. Martin, 22 May 1888, A. B. Langlois, NY) was consigned to synonymy under *Lophiosphaera lignicola* Sacc. by Berlese (1890), a species having larger ascospores, and under *L. semiliberum* (Desm.) Ces. & De Not. by Chesters and Bell (1970), but that species on grass culms has much longer ascospores (L. & K. Holm 1988).

Lophiostoma spiraeae Peck is related to the European *L. alpigena* Fuckel [hyaline-spored *Massariosphaeria alpigena* (Fuckel) L. & K. Holm] and was consigned to synonymy under that species by Chesters and Bell (1970). The ascospores are consistently narrower, 5-6 µm compared to 10 µm, and ascomata are large, 550-770 µm wide. *Lophiostoma massarioides* (Sacc.) L. & K. Holm is another related species, again having wider ascospores.

Lophiostoma winteri (Sacc.) Winter is related to *L. caulium* as L. and K. Holm (1988) remarked, has relatively wider ascospores and develops in woody substrates. One North American collection, on *Potentilla fruticosa* L. (CANADA: Newfoundland: Cook's Harbor, 16 Aug 1957, R. T. Wilce 273, DAOM) has ascospores up to 40 µm long (Fig. 1 x) and illustrates the remarks by L. and K. Holm (1988) that the species "...seems to have a distinctive ecology with a preference for ± creeping dwarf-shrubs."

Additional collections from old weathered stems of *Artemisia tridentata* Nutt. (USA: Utah: Cache Nat'l Forest, road to Curtis Creek, 31 Jul 1985, C. T. Rogerson; N slope Wasatch Ridge, 26 Jul 1979, NY) lack appendages on the ascospores but are similar in ascospore shape, sizes, and light brown pigmentation and roughened surfaces of the widely erumpent ascomata.

Lophiotrema, in the restricted sense of L. and K. Holm (1988), may be separated from *Lophiostoma* by the type of peridium, nearly equal in width and pigmentation throughout, and by oblong cylindric asci. Ascospores vary in shape among the species and usually remain hyaline and one-septate but may become lightly pigmented and three septate. North American species include the following.

1. Ascospores ellipsoid biconoid, 18-25(-29) x 5.5-7(-10) µm; apex of ascoma usually as compressed papilla, in wood..*L. nucula*
1. Ascospores fusoid or oblong, narrower................2
    2. Ascospores 18-27.5 µm long; apex of ascoma forming compressed papilla.................................3
    2. Ascospores shorter, up to 20 µm long; apex of ascoma obtuse, opening by a long slit..............4
3. Ascospores fusoid, 22-27.5 x 4.5-6.5 µm, constricted in each hemispore, surrounded by wide gel coating; in herbs and canes.............................*L. vagabundum*
3. Ascospores oblong, 18-24 x 4-5 µm, not constricted in each hemispore, lacking gel coating; in wood....*L. velatum*
    4. Ascospores 14-17 x 3-4 µm.......*L. neohysterioides*
    4. Ascospores (15-)18-20 x 4-4.5 µm........*L. alpinum*

Lophiotrema alpinum (Ellis & Everh.) Barr, comb. nov.
Fig. 2a, b
Melanopsamma alpina Ellis & Everh. Bull. Torrey Bot. Club 24: 458. 1897.
Abaphospora alpina (Ellis & Everh.) Kirschst. Ann. Mycol. 37: 98. 1939.

Ascomata gregarious to crowded, immersed erumpent, rounded or ellipsoid, 330-385 µm wide, up to 500 µm long, apex rounded, short inconspicuous slit; peridium dark reddish brown, 25-30 µm wide, externally of heavily pigmented rows of small slightly compressed cells, internally hyaline and compressed, hyphae into substrate from lower sides and base. Asci 80-100 x 7-11 µm, cylindric. Pseudoparaphyses narrowly cellular, sheetlike above asci. Ascospores (15-)18-20 x 4-4.5 µm, hyaline, fusoid, 1-septate, median, slightly constricted; wall smooth; two globules per cell, uniseriate to partially biseriate in the ascus.

In decorticated conifer wood and cone scales.

Collections examined. USA: Colorado: spruce wood, San Juan Mts., Jul 1897, E. Bethel 352 part (holotype, NY); cone scales of *Pinus flexilis* E. James, Minnehaha, 3 Jul 1906, F. E. & E. S. Clements, Crypt. Form. Colorad. 232 (NY).

Ascomata are similar in shape to those of *L. neohysterioides* and open by a long slit in the rounded apex; ascospores are larger and have only one septum. In the description this species was compared to *M. boreale* Ellis & Everh., but that species is more widely erumpent in subiculum, has a definite caplike, rounded apex and is assigned to *Herpotrichia* in this article.

Lophiotrema neohysterioides Barr, nom. nov. Fig. 2 c,d
Sphaeria hysterioides Schwein. Trans. Amer. Philos. Soc. 4: 216. 1832.
Lophiostoma hysterioides (Schwein.) Sacc. Syll. 2: 709. 1883.
Lophiostoma hysterioides Ellis & Langlois, J. Mycol. 4: 76. 1888.
Lophiotrema hysterioides (Ellis & Langlois) Berlese, Icon. Pyrenomyc. 1: 4. 1890.

Ellis and Everhart (1892) believed that two different species were involved, but Chesters and Bell (1970) determined that only one species could be recognized. A new name is needed in *Lophiotrema* because of Berlese's use of the later homonym in the genus. The species forms on wood aggregates of oblong ascomata with rounded apices opening by low, elongate slits; the peridium is nearly equal throughout, asci are narrow. *Lophiotrema boreale* Mathiessen (L. and K. Holm 1988, Mathiessen 1989) is closely related and differs chiefly in narrower asci and more constricted ascospores from *L. neohysterioides*.

Lophiotrema nucula (Fr.: Fr.) Sacc., the lectotype species, is common on woody substrates, and was redescribed by L. and K. Holm (1988). *Lophiostoma (Lophiosphaera) asperum* Ellis & Everh. [Proc. Acad. Nat. Sci. Philadelphia 46: 332. 1984; *Lophiosphaera aspera* (Ellis & Everh.) Sacc. Syll. Fung. 11: 383. 1893] is a synonymous name, as Chesters and Bell (1970) indicated in their listing of the holotype; so are the unpublished names *Lophiostoma querceti* Sacc. & Speg. var. and forma *ulmicola* Ellis & Everh. Another synonym is *Melanopsamma kansensis* Ellis & Everh. (Erythea 2: 17. 1894; USA: N.A.F. 3010, *Ulmus americana L.*, Kansas: Rockport, Nov 1893, E. Bartholomew, NY).

Lophiotrema vagabundum (Sacc.) Sacc., includes *L. rubidum* Sacc., Rouss. & Bommer, a variant that causes reddening of the substrate,and occurs on herbaceous stems and some soft woody twigs such as *Lonicera, Rubus*, etc.

Lophiotrema velatum (Ellis & Everh.) Barr, comb. nov.
Glonium velatum Ellis & Everh., North Amer. Pyrenomyc. 684. 1892.
Solenarium velatum (Ellis & Everh.) Kuntze, Rev. Gen.

Pl. 3: 521. 1898.

Lophiosphaera velata (Ellis & Everh.) Lohman, Amer. J. Bot. 21: 314. 1934.

Lohman (1934) described and illustrated this species in detail. He determined that it has both a hyphomycetous anamorph, *Septonema multiplex* Berk. & Curtis [*Taeniolella multiplex* (Berk. & Curtis) Hughes, Canad. J. Botany 36: 817. 1958], and a coelomycetous synanamorph in culture. Authentic specimens of *Septonema multiplex* (in Herb. Curtis, FH, South Carolina: Society Hill, *Quercus alba L.*, Oct 1849, n. 2751 and *Nyssa*, 1853, n. 4033) both contain immature ascomata in addition to the hyphomycete.

Massarina. The European species of *Massarina* were revised by Bose (1961) and added to by Müller in Müller and von Arx (1962), Sivanesan (1984), who included some aquatic species having hyphomycetous anamorphs, and Leuchtmann (1984). Several of these species are cosmopolitan, known in North America as well as Europe. Other species are added from North America, and the following key aids in their recognition.

1. Ascospores ellipsoid, ends obtuse....................2
1. Ascospores fusoid, ends more or less acute..........10
2. Ascomata large (500-700 µm); ascospores (22-)27-37.5 x (8-)9-14.5 µm........................*M. eburnea*
2. Ascomata medium or small sized..................3
3. Ascomata medium sized (275-500 µm), papilla short and wide...4
3. Ascomata small (130-270 or up to 330 µm).............8
4. Ostiolar region reddish.........................5
4. Ostiolar region whitish.........................6
5. Apical papilla upright; ascospores 25-36(-39) x (7.5-)9-12(-13) µm...............................*M. leucosarca*
5. Apical papilla eccentric or lateral; ascospores 20-30 x 7-9(-10) µm.................................*M. eccentrica*
6. Ascospores 20-24 x 9-11 µm; clypeus formed above ascomata in substrate....................*M. grumata*
6. Ascospores longer and relatively narrower; ascomata lacking clypeus.........................7
7. Ascospores 28.5-33 x 5.5-6.5(-9) µm, 1-3-septate....... *M. canadensis*
7. Ascospores 35-40 x 10-12 µm, 5-septate................ *M. quinqueseptata*
8. Ascomata much depressed, usually separate; ascospores (20-)22-27.5(-38) x (4.5-)6-7(-11) µm..... *M. corni*
8. Ascomata slightly depressed, gregarious in monocots...9
9. Ascospores 18-25 x 6-9 µm; apex of ascoma rounded papillate...................................*M. palmetta*
9. Ascospores 20-30 x 6-8 µm; ascomata at times forming ellipsoid groups and obtuse apex opening by slit.......... *M. xerophylli*

10. Ascomata large, often ellipsoid, apex rounded, opening by rounded pore or short slit; ascospores 32-40 x 8-10 µm............................*M. lignorum*

10. Ascomata medium or small sized, opening by rounded pore.....................................11

11. Ascomata medium sized (275-500 µm)..................12

11. Ascomata small sized (130-270 or to 330 µm).........15

12. Apex of ascoma forming short wide papilla, ostiole yellowish; ascospores 15-22 x 4-6 µm......... *M. albocarnis*

12. Apex of ascoma papillate or not, ostiole whitish. 13

13. Ascomata subglobose; ascospores (15-)22-31(-40) x (3.5-)4.5-6(-7.5) µm.......................*M. corticola*

13. Ascomata much depressed..............................14

14. Ascomata separate, in dicots; ascospores 26-30.5 x 7-9 µm.................................*M. myricae*

14. Ascomata gregarious, connected by hyphae, in monocots; ascospores 24-32 x 6-7 µm...*M. arundinariae*

15. In monocots, clypeus usually connecting several ascomata; ascospores 22-33 x 4-5.5 µm.......*M. arundinacea*

15. In dicots, clypeus minute as thickening around apices of individual ascomata; ascospores 15.5-28.5(-30) x (3-)5-7 µm...................................*M. microcarpa*

Massarina albocarnis (Ellis & Everh.) Barr, comb. nov.
Fig. 2 e,f
Diaporthe albocarnis Ellis & Everh. Proc. Acad. Nat. Sci. Philadelphia 45: 140. 1893.

Ascomata gregarious, immersed, rounded or ovoid, 300-450 µm wide; apex papillate, short and wide, pore area grayish at surface, yellowish below; peridium 16-40(-60) µm wide, reddish brown, compressed cells. Asci 69-100 x 7.5-9 µm, oblong cylindric. Pseudoparaphyses numerous, narrowly cellular, sheetlike and yellowish granular above asci. Ascospores 15-22 x 4-6 µm, hyaline, fusoid, 1-3-septate, constricted at first-formed septum; wall smooth, narrow gel coating (ca. 1 µm at sides), at times elongate over tips, 2-2.5 x 1.5-2.5 µm.

In woody branches, often over old ascomycetous stromata, eastern North America.

Collections examined. CANADA: Ontario: *Cornus*, London, May 1891, J. Dearness, NAF 2820. USA: Massachusetts: *Rhus*, Conway, 19 Nov 1960, M. E. Barr 2864; *Quercus*, off Rt. 116, Hadley, 22 Apr 1976, M. E. Barr 6312. Pennsylvania: West Chester, W. T. Haines 2441 as *Sphaeria (Bertia) submoriformis*. Vermont: *Hypoxylon* on *Fagus*, Newfane, 13 Jul 1961, M. E. Barr 2982a (all NY).

The well-developed papilla that is grayish on the surface, yellowish below, is characteristic of this species.

Massarina arundinacea (Sowerby: Fr.) Leuchtmann is known in eastern and central USA (Farr et al. 1989) and was described and illustrated by Leuchtmann (1984) and Shoemaker and Babcock (1989).

Massarina arundinariae (Ellis & Everh.) Barr, comb. nov. Fig. 2 g

Didymosphaeria arundinariae Ellis & Everh. North Amer. Pyrenomyc. 732. 1892.

Microthelia arundinariae (Ellis & Everh.) Kuntze, Rev. Gen. Pl. 3: 498. 1898.

Ascomata immersed, gregarious in slightly yellowed region of culm, visible at surface as blackened, circular, clypeal areas or these connected to form larger blotches, sphaeroid, 275-380 µm wide, 165-275 µm high, papilla to surface; peridium narrow, ca. 10 µm, light to dark brown, with loosely woven hyphae at sides. Asci (60-)70-100 x 12-15 µm, clavate. Pseudoparaphyses narrowly cellular, in gel matrix. Ascospores 24-32 x 6-7 µm, hyaline finally light brown, fusoid, 1-septate, median; wall smooth.

In dead *Arundinaria*.

Collection examined. USA: Louisiana: Labbe's wood near St. Martinsville P.O., 30 Oct 1890, A. B. Langlois, Fl. Ludov. 2338 (holotype, NY).

A second collection named *Didymosphaeria arundinariae*, on *Andropogon*, is *Amphisphaeria serrulata* (Ellis & G. Martin) Barr (Barr 1989c). *Massarina arundinariae* has larger, narrower, fusoid ascospores and smaller ascomata than the other species on monocots (*M. palmetta and M. xerophylli*), that have ellipsoid ascospores whose ends are obtusely rounded.

Massarina canadensis (Ellis & Everh.) Barr, comb. nov. Fig. 2 j

Didymella canadensis Ellis & Everh. Proc. Acad. Nat. Sci. Philadelphia 42: 232. 1890.

Cercidospora canadensis (Ellis & Everh.) Kuntze, Rev. Gen. Pl. 3: 453. 1898.

Ascomata separate or gregarious, immersed, sphaeroid, 200-300 µm wide, 140-200 µm high; papilla short; peridium 14-20 µm wide below, thickened as small clypeus, to 36-40 µm above, brown, slightly compressed rows of cells. Asci 82-97 x 16.5-18 µm, oblong. Pseudoparaphyses numerous, narrowly cellular, ca. 1.5 µm. Ascospores 28.5-33 x 5.5-6.5(-9) µm, hyaline finally light brownish, fusoid, 1-(3-) septate, constricted at first-formed median septum; wall smooth, verruculose in age, gel coating 1.5-2 µm wide.

In branches of *Salix*.

Collections examined. CANADA: Ontario: London, 27 Jan 1890, J. Dearness 1378 (holotype, NY). USA: Massachusetts: Baptist Hill, Conway, 19 Apr 1976, M. E. Barr 6310 (NY).

Massarina canadensis resembles *M. corticola* in ascospores, but the sphaeroid ascomata are smaller and inconspicuously papillate.

Massarina corni (Fuckel) Sacc., redescribed by Bose (1961), has ellipsoid ascospores as in *M. eburnea* but the ascomata are small. One North American collection fits this species: USA: Massachusetts: Leverett, 6 Jul 1961, M. E. Barr 2959 (NY).

Massarina corticola (Fuckel) L. Holm was redescribed by L. Holm (1957), Bose (1961), and Boise (1985b). Ascomata are medium sized and ascospores fusoid (Fig. 2h) This species is common in many woody substrates throughout North America.

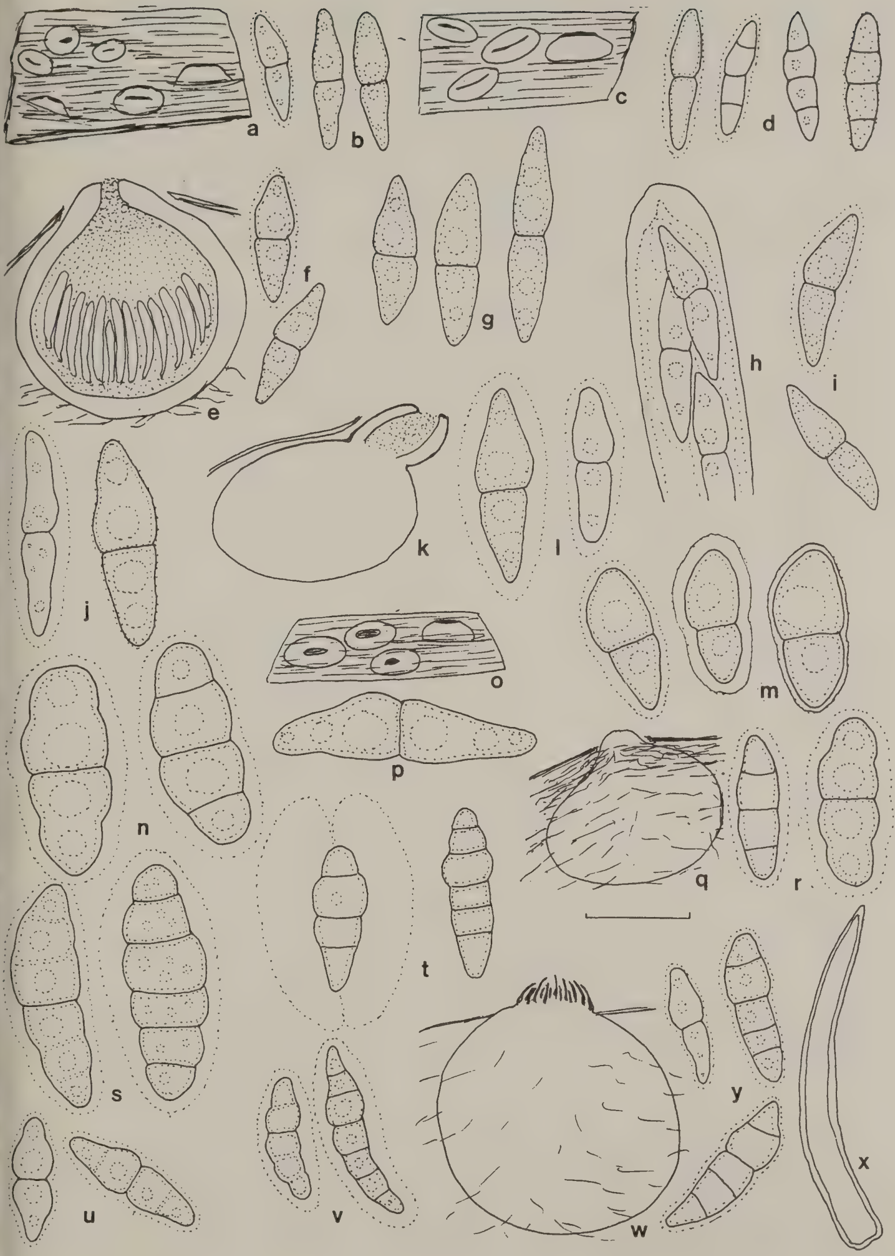
Massarina eburnea (Tul. & C. Tul.) Sacc. is the lectotype species of the genus, redescribed by Munk (1957) and Bose (1961), who included as a synonym *M. eburnoides* (Sacc.) Sacc. Large ascomata and ellipsoid ascospores characterize the species. In North America I have studied it on *Alnus*, USA: Vermont: Goldbrook Road, Stowe, Lamoille Co., 18 Sep 1964, M. E. Barr 4680b (NY).

Massarina eccentrica Barr, sp. nov. Fig. 2 k,l

Ascomata solitaria vel gregaria immersa sphaeroidea 300-500 µm lata 300-400 µm alta, papilla eccentrica vel lateralis 125-150 µm, peridium 20-35 µm vel super apicum 50-75 µm rubescens. Asci bitunicati clavati 100-125 x 15-20 µm. Pseudoparaphyses cellulosae. Ascosporae 20-30 x 7-10 µm hyalinae ellipsoideae 1-septatae. Holotypus in *Aceris macrophylli* Pursh cauli "Canada, British Columbia, Sidney, 27 Mar 1991" a M. E. Barr 7490 lectus in DAOM et NY depositus.

Ascomata separate or gregarious, immersed in periderm, sphaeroid, 300-500 µm wide, 300-400 µm high; apex papillate, eccentric to lateral, terete, 125-150 µm wide and high, periphysate, ostiole reddened; peridium of small, compressed rows of cells, reddish brown, 20-35 µm wide below, darker reddish brown above, to 50-75 µm wide. Asci 100-125 x 15-20 µm. Pseudoparaphyses narrowly cellular, numerous, 1-1.5 µm wide. Ascospores 20-30 x 7-10 µm,

Fig. 2. a, b. *Lophiotrema alpinum*, a, habit, b, ascospores. c, d. *L. neohysterioides*, a, habit, b, ascospores e, f. *Massarina albocarnis*, e, ascoma, f, ascospores. g. *M. arundinariae*, ascospores. h. *M. corticola*, ascus apex and ascospores. i. *M. microcarpa*, ascospores j. *M. canadensis*, ascospores. *k, l. M. eccentrica*, k, ascoma, l, ascospores. m. *M. grumata* ascospores. n. *M. leucosarca*, ascospores. o, p. *M. lignorum*, o, habit, p, ascospore. q, r. *M. palmetta*, q, ascoma, r, ascospores. s. *M. quinqueseptata*, ascospores. t. *Trichometasphaeria culmifida*, ascospores. u. *T. genistae*, ascospores. v. *T. gloeospora*, ascospores. w-y. *T. populi*, w, ascoma, x, seta, y, ascospores. Standard line = 15 µm for ascospores, 150 µm for ascomata. Habit sketches not to scale.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hyaline, ellipsoid, ends obtuse, 1-septate, constricted at septum; wall smooth, gel coating 2-3 µm wide, expanding to 5 µm in water; two globules per cell; overlapping biseriate in the ascus.

In branches of shrubs and trees, British Columbia.

Additional collections examined. *Holodiscus discolor*, Sidney, 5 Jun 1990, M. E. Barr 7185, 15 Apr 1991, 7517; *Lonicera ciliosa* (Pursh) Poir., 26 May 1991, 7578; *L. hispidula* (Lindl.) Douglas ex Torr. & A. Gray, 26 Aug 1990, 7272, 23 Oct 1990, 7350; *L. involucrata*, 11 Jun 1991, 7613, 6 Mar 1992, 8003; *Acer macrophyllum*, 7 May 1991, 7556; *Arbutus menziesii*, 14 Dec 1991, 7896, 3 Jan 1992, 7927 (all DAOM).

Massarina eccentrica has in common with *M. leucosarca* reddish brown peridium and red-tinged ostiolar tissues. The ascospores are similarly shaped but somewhat smaller. The position of ascomata varies from slightly eccentric to decidedly horizontal, but all other aspects are of *Massarina*.

Massarina grumata (Cooke in Saccardo) Barr, comb. nov. Fig. 2 m

Didymosphaeria grumata Cooke in Saccardo, Syll. Fung. 1: 714. 1882, as Cooke and Ellis.

Sphaeria grumata Cooke in Ellis NAF 185. 1878, nom. nud.

Ascomata immersed becoming erumpent, gregarious, sphaeroid, 300-450 µm wide, 300-350 µm high; papilla short and wide; peridium 12-20 µm wide, dark brown, rows of compressed cells, extended above as blackened clypeus, up to 40-70 µm wide, host cells included, brown hyphae from lower sides and base. Asci 63-105 x 13.5-18 µm, oblong, inflated in lower third. Pseudoparaphyses numerous, narrowly cellular. Ascospores hyaline, 20-24 x 9-11 µm, broadly ellipsoid, 1-septate, slightly submedian, constricted; wall smooth, gel coating firm, 1.5-2 µm.

In branches of "Andromeda" = *Lyonia ligustrina* (L.) DC.

Collection examined. USA: New Jersey: Newfield, Ellis NAF 185 (isotype, NY).

This species is distinctive by the wide ascospores whose outer coating is firm, not as delicate as are most gel coatings. The ascomata are much like those of *M. albocarnis*, but are darkened above by a hyphal clypeus and lack a well-developed papilla with yellowish ostiolar region.

Massarina leucosarca (Ellis & Everh.) Barr, comb. nov. Fig. 2 n

Diaporthe leucosarca Ellis & Everh. Proc. Acad. Nat. Sci. Philadelphia 42: 233. 1890.

Ascomata separate to gregarious, immersed, sphaeroid, (330-)400-450(-550) µm wide, 200-250(-330) µm high; papilla short and wide, ostiole reddish; peridium 10-20

(-33) µm wide below, thickened above as small clypeus, up to 40 µm wide, dark reddish brown rows of compressed cells. Asci (80-)100-150 x (15-)18-26.5 µm, clavate oblong, 2-4-8-spored. Pseudoparaphyses numerous, narrowly cellular, 2-2.5 µm, in gel matrix. Ascospores 25-39 x (7.5-)9-13 µm, hyaline, ellipsoid, 1-(3-5-)septate; gel coating 2.5-3.5 µm wide.

In woody branches.

Collections examined. CANADA: Ontario: *Carpinus caroliniana* Walter, London, May 1890, J. Dearness, NAF 2743 (isotype). USA: Georgia: *Aucuba japonica* Thunb., U. Georgia Bot. Garden, Athens, Clarke Co., 25 Aug 1978, M. E. Barr 6464. Maine: *Alnus*, S. of Carrabassett, Franklin Co., 27 Aug 1971, M.E. Barr 5850c. Massachusetts: *Carpinus caroliniana*, Pine Hill Road, Conway, 30 Aug 1960, M.E. Barr 2810; Amherst, 13 Jul 1967, M. E. Barr 4979. New Hampshire: *Betula*, Rocky Branch Trail, Jericho, White Mts. Nat. Forest, 12 Aug 1963, M.E. Barr 4063a (all NY).

The large ellipsoid, obtusely ended ascospores are rather variable in size, in two-, four- or eight-spored asci, but are consistently deeply constricted at the median septum, and additional septa are infrequent. Wehmeyer (1933) observed that *Diaporthe leucosarca* was one of the "Massariaceae" and excluded the species from *Diaporthe*.

Massarina lignorum (Wehmeyer) Barr, comb. nov. Fig. 2 o,p

Massarinula lignorum Wehmeyer in Cooke, Mycologia 41: 611. 1949.

Ascomata gregarious to crowded, immersed in blackened wood fibers, sphaeroid, usually ellipsoid, 0.5-1 mm long, 440-660 µm wide, 385-550 µm high; apex obtuse, pore rounded or somewhat elongate; peridium dark brown, of small pseudoparenchymatous cells, 30-52(-78) µm wide at base, up to 104 µm above, extending as thin clypeus of dark hyphae. Asci (85-)120-150 x 16-22 µm. Pseudoparaphyses narrowly cellular, sheetlike in gel matrix above asci. Ascospores 30-40(44) x 7.5-10(-12) µm, hyaline, rarely becoming light brownish, fusoid with tapered obtuse ends, 1-septate, constricted at median septum and in each hemispore; wall smooth; two globules per cell.

In decorticated branches and wood.

Collections examined. CANADA: British Columbia: driftwood, Sidney, 23 Jul 1990, M. E. Barr 7222; *Lonicera ciliosa*, Sidney, 4 Nov 1990, M. E. Barr 7369; *Gaultheria shallon* Pursh, 16 Jun 1991, M. E. Barr 7619 (all DAOM). USA: Utah: *Populus tremuloides* Michx., Cedar Mt., Iron Co., 17 Aug 1973, M. E. Barr 6091 (NY).

Disposition of this fungus proved puzzling because of the variable shape of apical pore in the obtuse apices of ellipsoid ascomata. No ridge is formed, and although some species in *Lophiostoma* have only a rounded apex with long slit, that slit is narrower and more conspicuously elongate than it is in the specimens cited above. In addition, the ascospores are massarinoid, and the species is reminiscent of an oversized *M. corticola.* My collections agree well with Wehmeyer's description and figures (in Cooke 1949) and the extreme ascospore sizes in the description above are his. He compared the species to several in *Massarina.* Bose (1961) included *Massarinula* without comment as a synonym of *Massarina.* Müller in Müller and von Arx (1962) transferred the type species, *Massarinula quercina* Gén. de Lam. to *Massarina.* The species with one-septate ascospores are not otherwise separable from those having three or more septa in the ascospores.

Massarina microcarpa (Fuckel) Sacc. was redescribed by Bose (1961). The small ascomata and fusoid ascospores (Fig. 2i) set this species apart. It is common on small woody twigs of numerous plants throughout North America, more rarely on coriaceous leaves, and is most readily separated from *M. corticola* by smaller ascomata and by ascospores that are more asymmetric having the lower cell often slightly angled.

Massarina myricae (Peck) Berlese, Icon. Fung. 1: 120. 1894.

Metasphaeria myricae Peck, Rep. New York State Mus. 38: 105. (for 1884) 1885.

Ascomata gregarious, immersed, raising periderm, sphaeroid and much depressed, 350-490 µm wide, 245-315 µm high, apex short papillate, ostiole whitish; peridium of brown compressed rows of cells, 22-30 µm wide at sides, 7-15 µm at base, thickened above to 52-60 µm. Asci 90-112 x 13.5-18 µm, clavate. Pseudoparaphyses numerous, narrowly cellular. Ascospores 26-30.5 x 7-9 µm, fusoid, 1-septate, constricted, indented in each hemispore; wall smooth.

In branches of *Myrica gale* L.

Collection examined. USA: New York: Caroga, Fulton Co., Jul 1884, C. H. Peck (holotype, NYS).

This species is comparable to *M. corticola* rather than to *M. eburnea* (Barr et al. 1986), which has much larger ascomata and larger, ellipsoid ascospores. *Massarina myricae* differs from *M. corticola* in the strongly depressed ascomata and wider ascospores.

Massarina palmetta (Cooke) Barr, comb. nov. Fig. 2 q,r

Sphaeria palmetta Cooke, Grevillea 7: 53. 1878.

Metasphaeria palmetta (Cooke) Sacc. Syll. Fung. 2: 177. 1883.

Ascomata immersed, separate to gregarious, surface often blackened, sphaeroid, 190-330 µm wide, 165-250 µm high, apex short papillate to surface; peridium reddish brown, slightly compressed cells, 15 µm wide at sides, base thinner, up to 10 µm, pallid. Asci 60-95 x 10-18 µm, oblong. Pseudoparaphyses numerous, narrowly cellular, 2-2.5 µm wide. Ascospores 18-25 x 6-9 µm, hyaline, oblong ellipsoid, ends obtuse, 1-3-septate, constricted at first-formed septum; wall smooth, narrow gel coating; biseriate in the ascus.

In *Sabal palmetto* (Walter) Schult. & J. H. Schult.

Collections examined. USA: Georgia: Darien, H. W. Ravenel, F. Amer. Exs. 369 (presumed isotype, NY). Florida: Oscar Scherer Rec. Area., Sarasota, 17 Jan 1987, H. E. Bigelow (NY).

Sphaeria sabaligera Berk. & Curtis could be an earlier name for this taxon, as Ellis and Everhart (1892) remarked. According to their information and the sparse material available for study from Louisiana (Pointe à la Hache, 23 Nov 1886, A. B. Langlois), asci and ascospores are smaller (40-60 x 7-10 and 15-22 x 4-5 µm, respectively) and the ascospores become light yellowish or pinkish brown. *Massarina floridana* Petrak (Sydowia 5: 240. 1951; non Sydowia 6: 7. 1952, a later homonym) is probably identical to *M. palmetta*. Petrak noted the similarity but stated that Ravenel 369 differed in scattered ascomata, narrower asci and ascospores lacking gel coating. My studies of that specimen in NY showed gregarious ascomata, relatively wide asci (85-95 x 12-14 µm), and a gel coating on the ascospores. Petrak did describe wider asci (21-26 µm) in his species.

Massarina quinqueseptata Barr, sp. nov. Fig. 2 s

Ascomata immersa gregaria globosa vel 385 µm diametro, papilla breves, peridium 30 µm vel super apicum 40-50 µm. Asci bitunicati oblongi 100-110 x 15-18 µm. Pseudoparaphyses cellulosae. Ascosporae 35-40 x 10-12 µm hyalinae vel ochraceae ellipsoideae 5-septatae. Holotypus in *Sambuci caeruleae* Raf. cauli "USA, California, below Battle Creek Crossing, Tehama Co., 9 Oct 1981" a W. B. & V. G. Cooke 60783B pro parte in NY depositus.

Ascomata immersed, gregarious, nearly globose, up to 385 µm wide, apex with wide papilla, pore whitish; peridium of brown, slightly compressed rows of cells, ca. 30 µm wide at base and sides, 40-50 µm wide over apex. Asci 100-110 x 15-18 µm, oblong. Pseudoparaphyses numerous, narrowly cellular. Ascospores 35-40 x 10-12 µm, hyaline becoming light brown in age, ellipsoid,5-septate, constricted at first-formed septum; wall smooth, with gel coating; overlapping biseriate in the ascus.

In branches of *Sambucus caerulea*. Known from the type collection.

Massarina leucosarca is close in sizes, but has a reddish ostiole and mostly one-septate ascospores. *Massarina canadensis* is a similar species whose ascospores are smaller and one to three septate.

Massarina xerophylli (Ellis) Barr, comb. nov.

Leptosphaeria xerophylli Ellis, Amer. Nat. 17: 316. 1883.

Sphaerulina xerophylii (Ellis) Cooke, Grevillea 18:

79. 1890.

Shoemaker (1984a) redescribed and illustrated this species in his study on species of *Leptosphaeria*. He included as a synonym *L. hysterioides* Ellis & Everh. [Bull. Washburn Coll. Lab. Nat. Hist. 1: 4. 1884; *Heptameria hysterioides* (Ellis & Everh.) Cooke, Grevillea 18: 32. 1889; *Massarina hysterioides* (Ellis & Everh.) Berlese, Icon. Pyrenomyc. 1: 119. 1894]. Ellis and Everhart (1892) said that *L. xerophylli* on *Xerophyllum asphodeloides* (L.) Nutt. from New Jersey was "doubtfully distinct" from *L. hysterioides* on *X. tenax* (Pursh) Nutt. from Washington. Shoemaker noted that the ascospores were *Massarina*-like and finally became reddish brown and echinulate. He cited collections from Alberta, Idaho and Oregon in addition to the types of the two species from New Jersey and Washington.

Trichometasphaeria species have hyaline, asymmetric, constricted phragmospores that may become light dull brown in age, and are surrounded by a wide gel coating. Ascomata usually have a thin basal peridium, darkened and wider above. A short papilla is formed of or covered by short dark setae. Munk (1953) selected *T. dianthi* (Rostrup) Munk as the type species. L. Holm (1957) synonymized this and other names under *T. gloeospora* (Berk. & Currey) L. Holm; he redescribed the genus and the species that he accepted. *Trichometasphaeria* was submerged under *Keissleriella* by Bose (1961), Müller and von Arx (1962), von Arx and Müller (1975), but the two genera are separated because species of *Keissleriella* have a different centrum. They are arranged in the Melanommatales (Barr 1990a). Barr in Barr et al. (1986) thought that *Massarina* could be enlarged to accommodate species of *Trichometasphaeria*, but now prefers to retain the genus for species whose ascomata have short setae composing or covering the apical papilla, in this respect quite similar to the dictyosporous species of *Ciliopleа*.

1. Ascospores 1-(3-)septate, (15-)18-20 x 5-6 µm.......... *T. genistae*
1. Ascospores 3-5- or 4-6-septate, usually longer........2
    2. Ascospores 16-22(-25) x 5-7 µm, 3-5-septate; in monocots................................*T. culmifida*
    2. Ascospores (3-)4-6-septate; in herbaceous substrates or decorticated wood.....................3
3. Ascospores 18-28(-30) x (3.5-)5-7.5 µm; usually in herbaceous substrates.......................*T. gloeospora*
3. Ascospores 16-24 x (4-)5-8 µm; in decorticated wood.... *T. populi*

Trichometasphaeria culmifida (Karsten) L. Holm develops in monocot leaves and culms, and has 3-septate ascospores, 16-22(-25) x 5-6 µm according to Holm. A collection in *Uniola latifolia Michx.* (USA: Oklahoma: Ripley Bluffs, Payne Co., 16 Aug 1979, M. E. Barr 6734, NY) has ascospores 18-22.5 x (5-)6-7 µm that become 4-5-septate and are surrounded by a gel coating up to 10 µm wide (Fig. 2 t). This is much like *T. taminensis* (Wegelin) L. Holm, which differs only in ascospores 20-24 x 6-7 µm, 5-septate. O. Eriksson (1967) found it difficult to separate two species, as I do.

Trichometasphaeria genistae (Fuckel) L. Holm is now known on *Cytisus scoparius* (L.) Link (CANADA: British Columbia: Mill Bay, 16 Nov 90, M. E. Barr 7381, Sidney, 17 Feb 1991, 7442, 27 May 1991, 7580, all DAOM) and has mostly one-septate ascospores (Fig. 2 u), in agreement with L. Holm's (1957) description.

Trichometasphaeria gloeospora (Berk. & Currey) L. Holm, the type species, develops in herbaceous stems, and also *Asparagus*, e.g. the type collection of *Leptosphaeria asparagi* Peck (Barr et al. 1986). Ascospores are 4-6-septate (Fig. 2 v). Another synonymous name is *Massarinula brassicae* Dearness & House (USA: New York: Orient, Long Island, 24 Sep 1915, R. Latham 713, NYS), apparently never published.

Trichometasphaeria populi (Ellis & Everh.) Barr, comb. nov. Fig. 2 w-y

Zignoella populi Ellis & Everh. Bull. Torrey Bot. Club 25: 502. 1898.

Ascomata separate to gregarious, immersed in wood fibers, becoming erumpent, sphaeroid, 330-385 µm wide, up to 330 µm high; apex with papilla of short dark setae, 60-100 µm long; peridium reddish brown, 30-40 µm wide, of small pseudoparenchymatous cells, with delicate brown hyphae into substrate. Asci (50-)60-100 x (10-)14-18 µm. Pseudoparaphyses narrowly cellular, numerous, sheetlike above asci. Ascospores 16-25 x (4-)5-8 µm, hyaline, becoming light brown in age, narrowly obovoid, (3-)4-5-(6-)septate, constricted at slightly supramedian, first-formed septum, cell above enlarged; wall smooth, narrow gel coating 1.5-2 µm wide; one globule per cell; overlapping biseriate in the ascus.

In decorticated branches.

Collections examined. USA: Colorado: *Populus angustifolia* E. James ex Torr., Fort Collins, Mar 1898, C. S. Crandall (holotype, NY); "1897" (NY). Kansas: *Rhus glabra* L., Rooks Co., 12 Sep 1895, E. Bartholomew 1935 on holotype of *Didymosphaeria rhoina* Ellis & Everh. (NY).

This species has darker and thicker-walled ascomata than *T. gloeospora*, and quite similar although shorter ascospores. *Massarina emergens* (Karst.) L. Holm, *Keissleriella emergens* (Karst.) Bose, was described from wood of *Populus tremula L.* in Finland, and has narrower, 1-(3-)septate ascospores, 18-20 x 5 µm (L. Holm 1957), or 17-23 x 4-5.5 µm (Bose 1961) in longer, narrower asci.

This species was reported as the teleomorph of *Diplodia tumefaciens* (Shear) Zalasky, found rarely on root galls of *Populus balsamifera* L. and *P. tremuloides* in Canada (Zalasky, 1974). The ascoma papilla is lined with short brown setae, but cylindric asci and narrow, symmetric ascospores separate this fungus from *T. populi* and make its position questionable in the genus.

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MYCOTAXON

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SINOBOLETUS, A NEW GENUS OF BOLETACEAE FROM CHINA

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ABSTRACT

An examination of the Boleti collections from Southwestern Yunnan, China, convinces the author to propose the Sinoboletus as a new genus, including two new species, Sinoboletus duplicatoporus and S. magniporus. Type specimens of the two new species are deposited in the Cryptogamic Herbarium, Kunming Institute of Botany, Academia Sinica (HKAS).

汉文摘要 在中国云南省境内发现牛肝菌科一新属，华牛肝菌属 *Sinoboletus* 其主要特征是子实层具双层菌管，该属现知两种：即重孔华牛肝菌 巨孔华牛肝菌 模式标本均存于中国科学院昆明植物研究所隐花植物标本馆。

撰稿人：臧 穆

Sinoboletus Zang, gen. nov.

Pileus convexus demum planoconvexus, siccus, tomentosus. Contextus tenuis vel crassus. Hymenium aureum vel flavum. Tubi bistrati, connexi, tubi superiores et inferiores. Pori minuti vel magni, rotundi vel angulares. Stipes obclavatus vel clavatus, apice striatus, nunquam reticulatus. Basdiosporae ovoideae vel ellipsoideae. Fibulatae adsunt.

Typus generis : Sinoboletus duplicatoporus Zang.

Pileus hemispheric, convex to plane, surface dry , tomentose. Context thinness or thickness, soft. Hymenium golden yellow to yellow. Tubes with crossveins producing in definite two layers, which with superior and inferior tubes, boletinoid and compound. Pores round at first, becoming angularis or irregular in age. Stipes subclavate or clavate, striate at the apex, surface dry, no reticulate. Basidiospores ovoid or ellipsoid. Clamp connections absent.

Entomology : Sino = Chinese; boletus = the genus *Boletus*, referring to the shape of the basidiocarp similar to that of the genus *Boletus*; found in China.

Sinoboletus is an unique genus belongs to the Boletaceae. The hymenium produces remarkable tubes with crossveins in two definite palisades, the tubes distinctly stratified in two clear layers. The two species referred here cannot be accommodated in any genus of Boletaceae currently known (R. Singer, 1947; E. J. H. Corner, 1972; W. H. Snell & al. 1970). The genus is clearly related to *Boletus* or *Xerocomus* (Teng, 1936; Chiu 1948), but differs in some significant ways. The hymenium has obvious tubes with a double layer, easily visible with a hand lens. It is easily recognized in the field, but cannot be accommodated in any genus of Boletaceae. Moreover, it differs also in its ellipsoid to occasionally ovoid basidiospores, never subfusiform or ellipsoid-fusiform and relatively thin or thick wall. This undescribed genus occurs in Southwestern Yunnan in a zone bordering the tropical monsoon forest. Concerning the ectomycorrhizal properties, the species are obligatorily associated mainly with Fagaceae and Pinaceae (Zang, 1985, 1986), especially associated with *Castanea calathiformis (Skan) Rehd. et Wils.* and *Castanea fleuryi Hick. et A. Gamus,* on which they probably form a mutually beneficial symbiotic relationship.

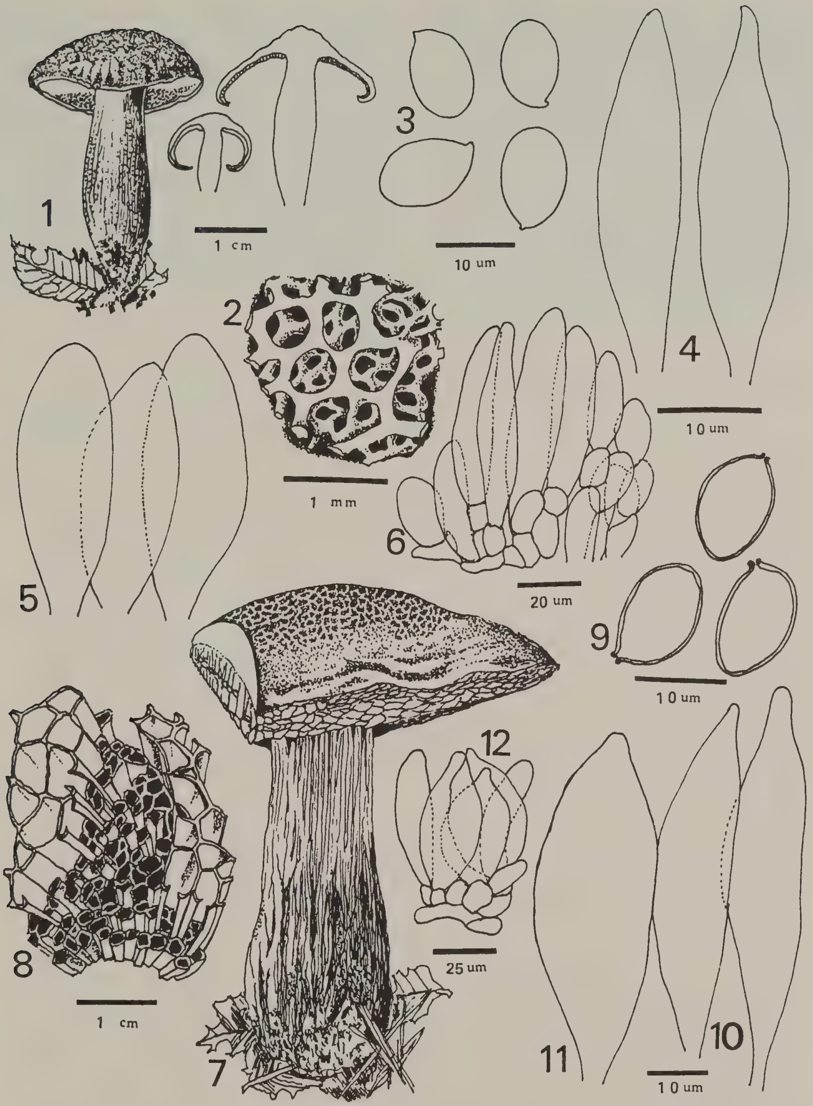
Sinoboletus duplicatoporus Zang, sp. nov. (Figs. 1-6;13)

Pileus 2-3 cm latus, convexus demum planoconvexus, siccus, rugulosus, tomemtosus, rubiginosus, rubro-brunneus, superficies pilei hyphis 5-12 um intertexta. Contextus 1-3 mm crassus, flavus, immutabilis. Hymenium aureum, tenue. Tubi bistrati, connexi, superiores 0.2-0.3 mm longi, 0.1 mm crassi, interiores 0.3 mm longi, 0.2 mm crassi, adnati, sinuatoadnati. Pori minuti, rotundi vel subrotundi. Stipes 3-4 cm longus, 0.7-1.2 cm crassus, obclavatus, apice striatus, fusiformis, nonquam reticulatus, siccus, flavidus, ochraceus. Mycelio flavo vel albido. Basidiosporae 10-11.5 X 3.9-7 um, ovoideae, ellipsoideae, leves, flavescohyalinae. In solutione Melzeri brunneo-aurantiacae. Pleurocystidia 20-35 X 9-13 um, fusiformia. Cheilocystidia 25-35 X 10-15.6 um, clavata. Fibulatae adsunt.

Habitat in sylvis humidis praecipue Castaneae calathiformis (Skan) Rehd. et Wils.

China: Yunnan, Jing Dong County, Ai Lao Mts. 2350 m. alt. 27 VIII 1991. G. Song 344 (Typus, HKAS: 23687)

Pileus 2-3 *cm* broad, hemispheric to convex, becoming broadly convex to plane, surface dry, somewhat wrinkled, tomentose at first, in age polished, rusty-red, reddish brown. Pileus cutis interwoven fascicles of hyphae 5-12 *um* wide, tubular, thin walled, end-cells clavate. Context thin, 1-3 *cm* thick, yellow, not changing when cut. Hymenium golden-yellow to bright yellow, thin. Tubes with crossveins produced in two definite layers, boletinoid and compound, the


1
1 cm
3
10 um
4
10 um
2
1 mm
5
6
20 um
9
10 um
12
8
1 cm
25 um
7
11
10
10 um

Figs. 1-6. Sinoboletus duplicatoporus Zang 1. Basidiocarps in profile and in section; 2. A part of hymenium; 3. Basidiospores ; 4. Pleurocystidia; 5. Cheilocystidia; 6. Pileus cutis.

7-12. Sinoboletus magniporus Zang 7. Basidiocarp; 8. A part of hymenium; 9. Basidiospores; 10. Pleurocystidia; 11. Cheilocystidium; 12. Pileus cutis.

superior tubes 0.2 -0.3 mm long, 0.1 mm diameter, the inferior tubes 0.3 mm long, 0,2 mm diam., adnate or subadnate.Pores small, round to mostly irregular round. Stipes 3-4 *cm* long, 0.7-1.2 *cm* thick, club-shaped, fusiform, often narrowed downward, solid, pale yellowish within striate above at the apex, yellowish-brown from base up, pale yellow velvety to the base. Mycelium pale yellowish white. Basidiospores 10-11.5 X 3.9-7 *um*, ovoid, elliptic ovoid, smooth, hyaline to pale yellow, in Melzer's solution golden brown. Pleurocystidia 20-35 X 9-13 *um*, fusiform. Cheilocystidia 25-35 X 10-15.6 *um*, clavate. Clamp connections absent.

Sinoboletus magniporus Zang, sp. nov. (Figs. 7-12; 14)

Pileus 14-20 cm latus, convexus demum plano-compressus, aurantiacus vel aureolinus, siccus, tomentosus, superficies pilei hyphae 4-8 um crassae, cellulae terminales 30-60 X 10-25 um. erectis instructa. Contextus 2-4 cm crassus, flavus, immutabilis. Hymenium aureum vel flavum, crassum. Tubi bistrati, connexi, superiores 2-4 mm longi, 0.5-1 mm crassi, inferiores 8-15 mm longi, 3.5-4.5 mm crassi, adnexi vel sinuatoadnexi. Pori magni, angulares vel irregulares, 3-4 per cm. Stipes 12-18 cm longus, 3-4.5 cm crassus, clavatus, subaequalis, basim versus bulbosus, apice striatus, siccus, nunguam reticulatus, rubidus vel rubiginosus. Mycelio flavo. Basidiosporae 10.4 - 11.7 X 7.8-9.1 um, ovoideae vel ellipsoideae, leves, aurantiacae. In solutione Melzeri brunneo-aurantiacae. Pleurocystidia 40-55 X 10.4-12 um, fusiformia. Cheilocystidia 40-50 X 14-16 um, late fusiformia. Fibulatae adsunt.

Habitat in sylvis Castaneae fleuryis Hick. et A. Gamus.

China : Yunnan, Lu Chun County, Da He Mts. 1300 m. alt. 2 X 1973. M. Zang 245 (Typus, HKAS 245)

Pileus 14-20 *cm* broad, hemispheric, convex to plane, surface very soft at maturity, pruinose or with a finely tanged-subtomentose, golden yellow or aureolin yellow, dry. Pileus cuticle a tangled layer of hyphae with free ascending tips, the terminal enlarged endcells of the trichodermial elements 30-60 X 10-25 *um*. Context thick, soft 2-4 *cm* thick, yellow, not changing when cut. Hymenium golden yellow to yellow, thick. Tubes with crassveins produced in two definite layers, boletinoid and compound. The superior tubes 2-4 *mm* long 0.5-1 *mm* diameter, the inferior tubes 8-15 *mm* long, 3.5 -4.5 *mm* diameter, adnate or sinuadnate. Pores round at first, becoming angular or irregular in age, large, 2-4 per *cm*. Stipes 12-18 *cm* long, 3-4.5 *cm* thick, cylibdric or subequal, solid, often subbulbous, red or rusty red, pallid within, atriate at the apex, surface dry, not reticulate, mycelium yellowish. Basidiospores 10.4

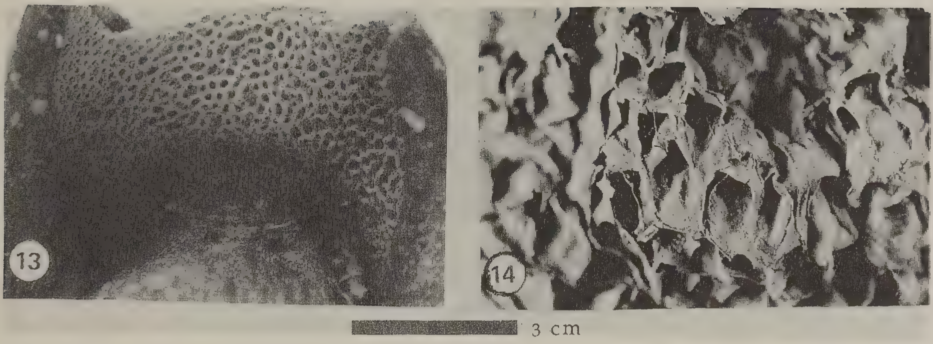


Fig. 13. Sinoboletus duplicatoporus Zang, showing a part of the hymenium. 14. Sinoboletus magniporus Zang, showing a part of the hymenium.

-11.7 X 7.8-9.1 *um*, ovoid, elliptic ovoid, smooth, golden yellow, wall slightly thickened, many with a truncate apex or apex appearing slightly notched, and with a small apical pore, shape in profile with a suprahilar depression, golden brown or orange brown in Melzer's solution. Pleurocystidia 40-55 X 10.4-12 *um*, fusiform. Cheilocystidia 40-50 X 14-16 *um*, broad fusiform. Clamp connections absent.

ACKNOWLEDGEMENTS

The author wishes to thank Professor Richard P. Korf, Cornell University. for his help and critical review of this manuscript and to Mr. G. Song, Department of Biology, Baoto Teacher's Training College, for collecting one of the specimens from Yunnan, and also wishes to thank Mr. H. Y. Li, Kunming Institute of Botany, for providing the photographs

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MYCOTAXON

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BISPORELLA CALYCELLINOIDES Sharma & Korf, A INDIAN SPECIES RECORDED FROM SPAIN

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SUMMARY

We report the discovery of *Bisporella calycellinoides* Sharma & Korf in Spain, compare it with type material of Indian origin and attribute the morphological variability of the paraphyses to climatic conditions experienced.

MATERIAL STUDIED

Herb. RG 6061, Cerezo de Arriba, Segovia, Spain, R. Galán & C. Lado (17-X-1982), on dead leaves of *Rosa sp.* (?).

Herb. CUP-IN 612, Nawephu, Bhutan, India, R. Sharma (18-IX-1980), on dead angiosperm leaves.

INTRODUCTION

The sojourn in Spain of the second author and collaborative work on herbarium collections of the foliicolous *Hyaloscyphaceae* belonging to the genera *Calycellina, Phialina, Mollisina,*...has given us the opportunity to study a fungus which we, without any doubt, initially considered to belong to one of these genera. This view was, however, rejected after microscopical study.

The fungus in question was represented by a large number of apothecia, from single to gregarious, developing on dead leaves of a probable *Rosa sp.*, completely sessile, cupulate (sometimes urceolate when dry), bright yellow when fresh (amber yellow when dry), small (≤ 0.5 mm diam.) with the receptacle clearly pilose (appearance retained after drying).

We were first tempted to include it in the *Hyaloscyphaceae*, which was rejected in favour of the *Leotiaceae* when we ascertained, with considerable surprise, an anomalous combination of characters: the presence of an excipulum formed of *hyphae with thick, gelatinized walls*, as well as evidence of *emergent hyphae* (in the margins and/or the flanks). All possibilities pointed solely in one direction: the genus *Bisporella*, redefined by KORF & CARPENTER (1974), although the foliicolous habit and the presence of definite hairs were not in accordance.

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We immediately referred to the description of *Bisporella calycellinoides*, a species suggested to us by its epithet, which SHARMA & KORF (1982) had proposed as new for science from the Himalayas (India) and described as "*minutely downy*" apothecia on "*dead angiosperm leaves*". The remainder of the characters (macro- and microscopical) were in agreement, except for the paraphyses, which, in our specimens, are consistently filiform-subclaviform and scarcely exceed the asci as against those described as "*lanceolate,...projecting up to 18 µm beyond the ascus tips*"and illustrated for *B. calycellinoides*.

In order to confirm fully the identity of our specimens, we applied for loan of the isotype (Herb. CUP) of *B. calycellinoides* and, after examination, our findings follow:

1. The general aspect of the fructifications (colour, form, size, habit,...) is identical in both cases. It is important, however, to emphasize that hairs are clearly visible under a dissecting microscope (Figs. 2, 3 & 9).

2. The ectal excipulum is not only formed in the same manner but is comparable to that of other species of the genus *Bisporella*.

3. The asci are indistinguishable, agreeing equally cylindric- claviform, weakly J+, octosporous, 53-60 x 6-8 µm in the Spanish material; additionally, the asci develop from croziers (Figs. 5-8 & 11).

4. The ascospores are identical: fusiform, inequilateral, permanently unicellular and contain polar guttules; 8.8-12 x 2.5-3 µm in the Spanish material.

5. The paraphyses in our material are pluriseptate, permanently **cylindrical** or **claviform** (x 3 µm diam.), simple or ramified at the base and **level** with or **slightly exceeding** the apices of the asci (Figs. 6-8). Numerous paraphyses in the isotype fit the original description (SHARMA & KORF, op. cit.) -Figs. 10, 11 & 15- as regards form and size. Nevertheless, others are perfectly filiform (x 2.8 µm diam.), obtuse and not normally exceeding the

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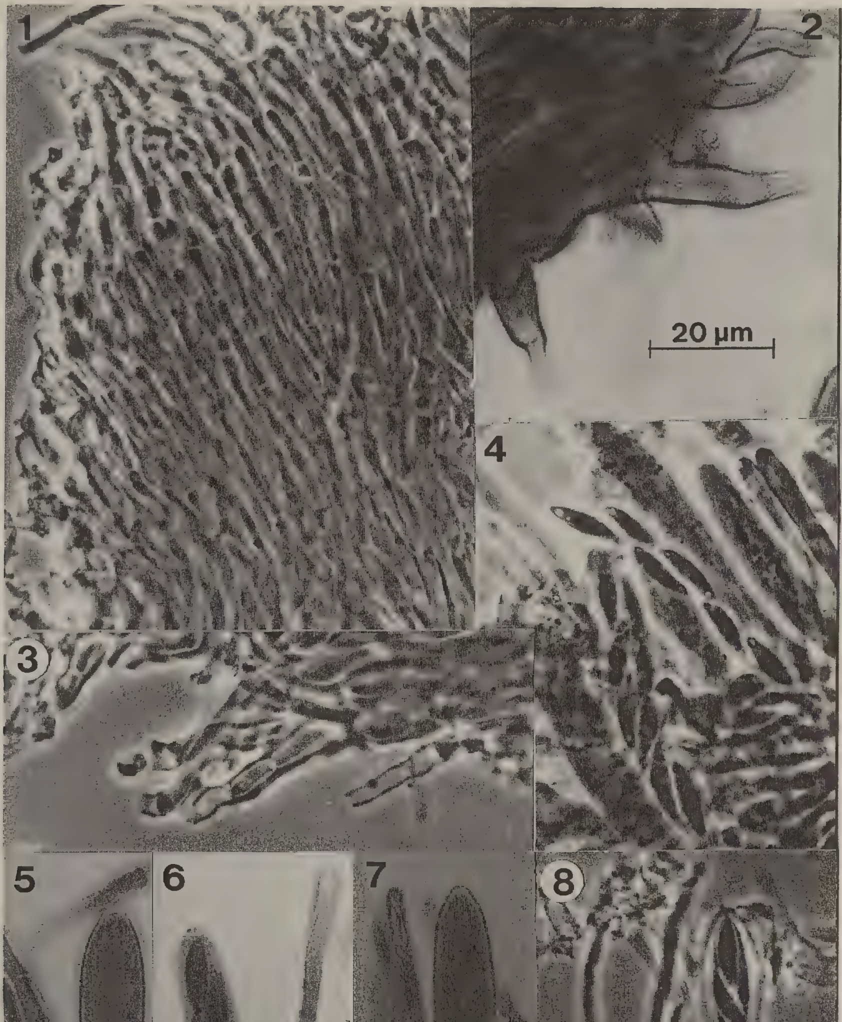
Figs. 1–8. *B. calycellinoides* (RG 6061): 1. Fragment of the Ectal Excipulum; 2 & 3. Hairs; 4. Spores; 5-8. Asci and paraphyses.


1
2
20 µm
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asci by more than 4-5 µm. Thus, there exists a gradual transition between one and the other types (Figs. 12-15).

CONCLUSIONS

We consider that the Spanish material under discussion is conspecific with *Bisporella calycellinoides* from India.

The lanceolate paraphyses are not characteristic of this foliicolous species; in fact, the very long, aberrant structures suggest that the fungus in the type specimen was probably growing under extreme ecological conditions.

This considerably increases the distribution of the species.

ACKNOWLEDGMENTS

We wish express our gratitude to Miss Susan C. Gruff for loan of the type specimen and to Mr. J. T. Palmer and Dr. R. P. Korf for their critical review of the original manuscript.

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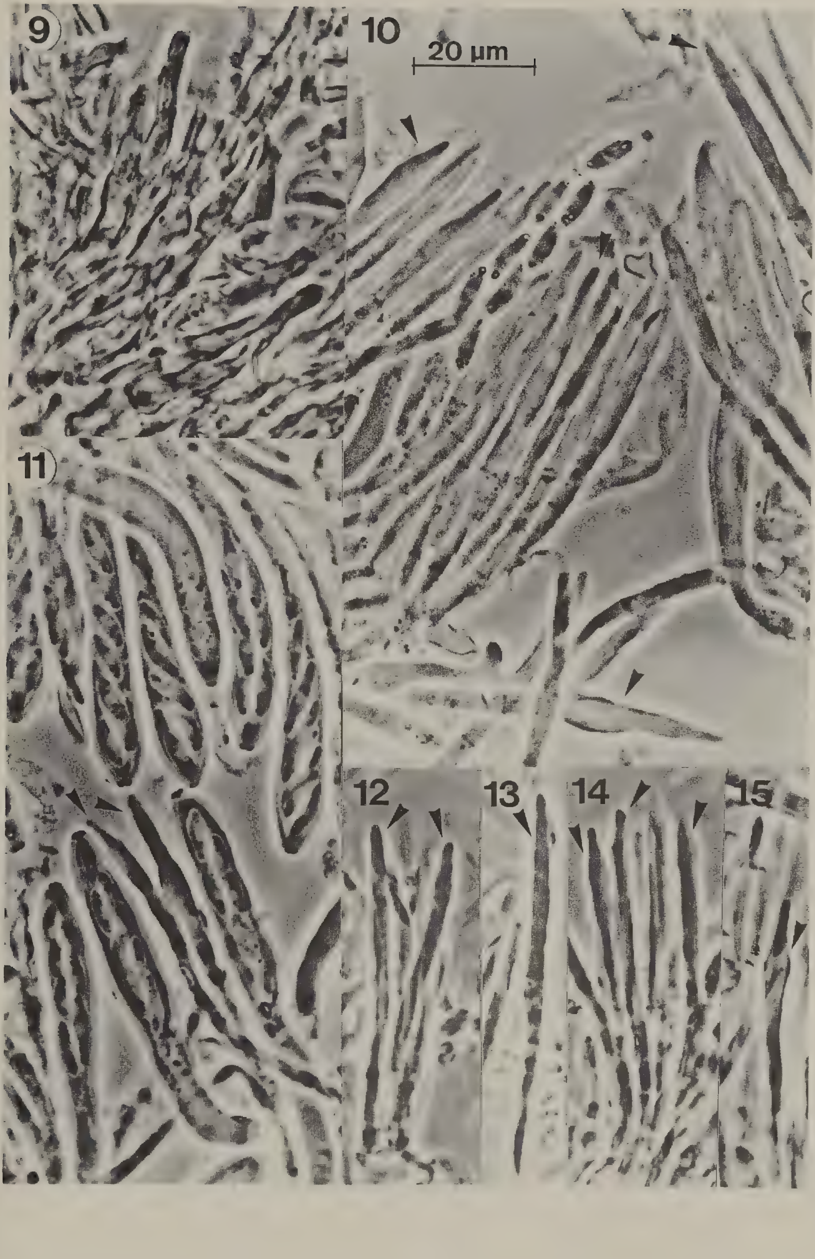
SHARMA, R. & R.P. KORF (1982)- *Two new species of Helotiales from the Eastern Himalayas.* **Mycotaxon** 16: 326-330.

Figs. 9–15: ***B. calycellinoides*** (CUP-IN 612): 9. Hairs; 10 & 11. Asci, paraphyses and spores; 12-15. Sample of the morphological variation in paraphyses (arrows= paraphyses).


9
10
20 µm
11
12
13
14
15

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ABSTOMA FRIABILIS sp.nov. (*GASTEROMYCETES*) FROM BAJA CALIFORNIA, MEXICO

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*** Departamento de Ciencias Biológicas, Universidad de Buenos Aires, Ciudad Universitaria (Núñez), 1428 Buenos Aires, Argentina.

Abstract: *Abstoma friabilis sp.nov.* is described. Macro- and microscopic features are illustrated.

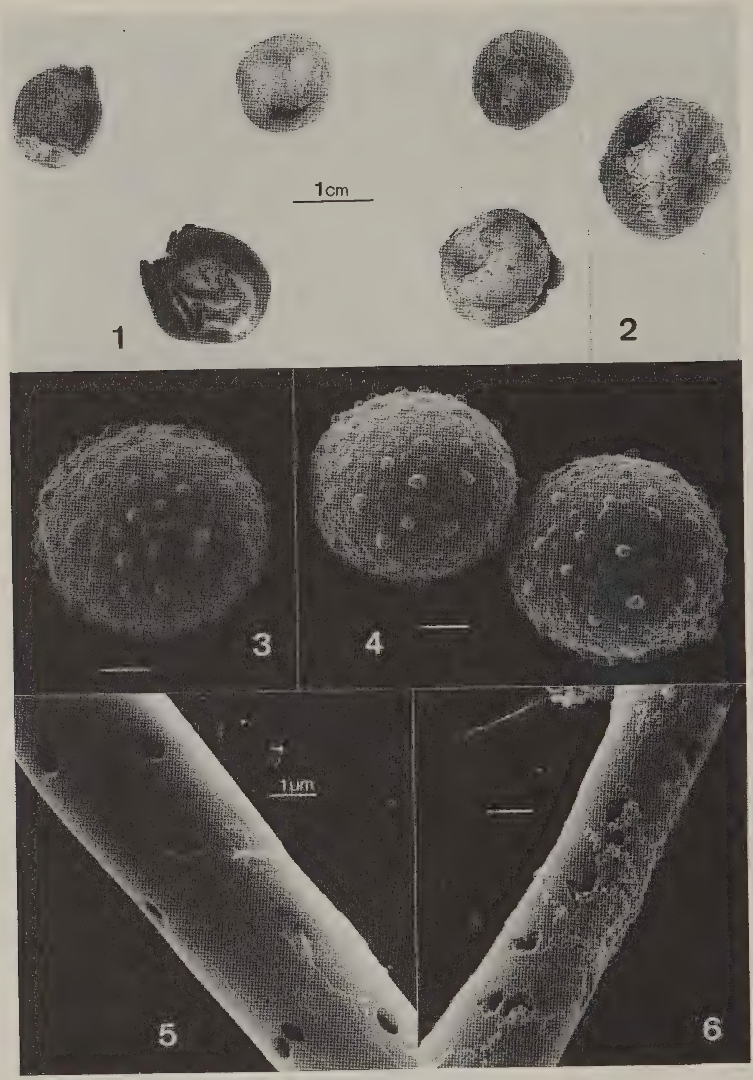
Key words: *Abstoma friabilis*, *Gasteromycetes*, taxonomy, Baja California, Mexico.

During two brief stays in Baja California (Mexico) by the first author in 1989 and 1990, as a result of a joint agreement with the Universidad de Baja California at Ensenada, several rare gasteromycetes with rather striking features drew our attention. Among them, *Abstoma friabilis* is here proposed as a new species. One year and a half later, we returned to the same area, collected it more abundantly and were able to study its macro- and microscopic features more accurately.

MATERIALS AND METHODS

The material studied has been deposited in the Herbarium of the Departamento de Biología Vegetal (Botánica), Universidad de Alcalá de Henares, Spain (AH). A duplicate has been also deposited in the Herbarium of the Real Jardín Botánico de Madrid (MA-fungi). The holotypes of *Abstoma verrucisporum* Wright & Suárez and *Calvatia herperia* Morgan were loaned from the Herbarium of the Departamento de Ciencias Biológicas, Universidad de Buenos Aires, Argentina (BAFC), and the National Fungus Collections, Beltsville, Maryland, U.S.A. (BPI), respectively. The New York Botanical Garden, Bronx Park, New York, U.S.A. (NY) loaned us additional collections of *C.hesperia*.

Samples of the gleba and peridium were mounted in lactophenol-cotton blue and Melzer´s reagent, and squashed to observe spores,


1cm
1
2
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4
1µm
5
6

Fig.1-6. *Abstoma friabilis* AH 114270 -holotype-. 1-2. fruit-bodies. 3-4. spores. 5-6. capillitium.

capillitium and peridial features. Some of the microphotographs were made under a Labophot microscope with an incorporated automatic system of photography.

We have also used a Zeiss DSM-950 S.E.M. Samples were treated in a Polaron E-5000 sputter-coater during 120 seconds at 1,4 kV and 18 mA in an atmosphere of Argon to obtain a golden coat of 500 Å. Spores and capillitium were mounted on aluminium stubs, wetting them in a drop of ethyl alcohol 50°, and later dried in the air.

Abstoma friabilis *sp.nov.* Figs.1-16.

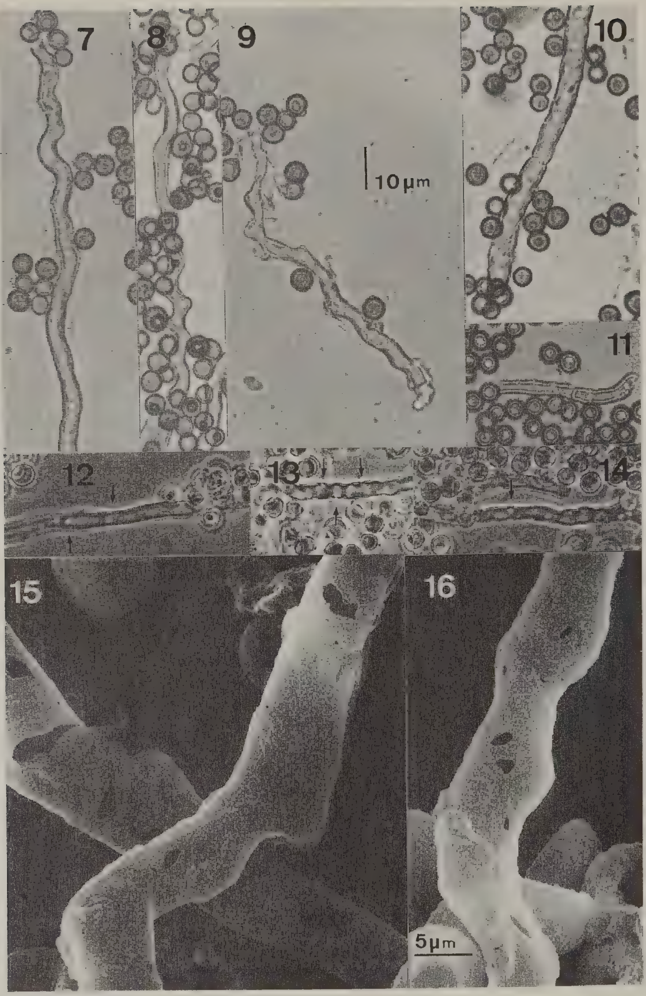
Gastrocarpo subgloboso, sessili, diminuto, usque 17 mm diam. Peridio fragili, duplo. Exoperidio ephemero. Endoperidio glabro, brunneo vel cupreo, papyraceo, tenuiter squamoso. Gleba pulverulenta ab peridio separabili. Stoma adest. Dehiscentia per ruptura pars superioribus peridii.

Exoperidio hyphis hyalinis, tenuitunicatis, parci ramificatis septatisque. Endoperidio crassior, hyphis parce septatis, filiis capillitiorum simulans, intrincatis, minus sinuatis vix perforatis. Sporis globosis, flavobrunneis, crassetunicatis, sub lente laevis, 4.3-5.7 µm diam.; sub microscopio electronico minute verrucosis. Capillitio tortuoso, ramosis, undulato, sinuoso, fragile, 2-7.5 µm diam., perforato usque 1.3 µm diam.

Holotypus *sub Ambrosia chenopodifolia in desertibus una cum Tulostoma meridionali et Disciseda bovista ad Km 71 viam San Quintin-Cataviña, Baja California septentrionale, Mexico, leg. C.Ochoa, N.Ayala, F.Esteve-Raventós, A.Altés & G.Moreno, 7-XI-1991, in herbario AH nº 14270 conservatus est.*

Gastrocarp subglobose, sessile, small, up to 17 mm diam. Peridium very fragile, of two layers. Exoperidium ephemeral, at maturity only persisting at the basal zone of the fruit-body. Endoperidium brown, sometimes with a cupreous metallic sheen, thinly papyraceous, fragile, breaking away in patches. Gleba powdery, detaching from the peridium at maturity. Stoma absent; dehiscence occurs by rupture in strips of the apical portion of the peridium. Sometimes a doubtful stoma appears which quickly tears away.

Exoperidium formed by hyaline, thin walled, hardly branched and septate, quite collapsed hyphae. Endoperidium thicker, formed by hyphae similar to capillitial threads, scantily septate, entangled, less sinuate, thinner and imperforate. Spores globose, yellowish-brown, thick-walled, smooth under L.M., guttulate, 4.3-5.7 µm diam.; under S.E.M. they exhibit very minute and sparse verrucae. Capillitium tortuous, branched, sparsely septate, 2-7.5 µm diam., not spiralled, but undulate or sinuate, of very unequal width, fragile; walls with numerous perforations up to 1.3 µm wide.


7
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10 µm
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Figs.7-16. *Abstoma friabilis* AH 12678. 7-14. capillitium and spores. 15-16. capillitium.

Material studied: The holotype; *ibid.*, *leg.* J.L.Manjón, G.Moreno, N.Ayala, C.Ochoa & M.Peinado, 15-II-1989, AH 13166; *ibid.*, *leg.* G.Moreno, R.Galán, N.Ayala & C.Ochoa, 13-III-1990, AH 12678; Km 55 Ensenada-San Felipe hway., sandy soil with *Adenostoma sparcifolius*, *Yucca schidigera* and *Opuntia bigelovii*, *leg.* N.Ayala, 2-III-1984, AH 14350.

Remarks: We are assigning this new species with some doubts in the genus *Abstoma* Cunn., since it differs by its notoriously perforated, non-spiralled capillitium, which would thus warrant a new emendation of the genus, considered as imperforate by WRIGHT & SUÁREZ (1990). The macro- and microscopic differences between the genera *Abstoma* and *Disciseda* Czern. are difficult to discern (Kreisel, pers.comm.). The same occurs between *Abstoma* and *Calvatia* Fr. (Demoulin, pers.comm.). Perhaps, in an exhaustive worldwide review it might be placed in one of these two genera.

We include in *Disciseda s.str.* small *Gasteromycetes* with a circular opening at the base of the peridium and with remains of the exoperidium and soil as a crust at the apex, which causes the mature sporocarps to turn over by their own weight; so that mature fruitbodies appear turned upside down as has been observed and illustrated by several authors (DOMÍNGUEZ, 1989). This has not been observed in our material which clearly shows the union with the substrate (fig.1). So we prefer to keep it in *Abstoma* for the moment.

Because of its fragile capillitium and way of dehiscence the present species could be assigned to *Calvatia* but differs substantially from any known species in this genus. *Calvatia hesperia* (Morgan, 1895), whose type we examined, has larger fruit-bodies (4-8 cm diam.), a rigid and persistent peridium, and usually a micelial cord like a root. The spores and capillitium are darker in colour and its threads have fewer and smaller perforations compared to those of the proposed new species. Judging from the original diagnosis of *C.diguetii* (Hariot & Patouillard, 1904) it is also different from *A.friabilis* because of its larger size (4-6 cm diam.), thicker and rigid peridium, and smaller spores (3-4 µm diam.).

The spores of *Disciseda singeri* (Moravec, 1954) measure 5,5-6,6(-7,6) µm diam., with obvious ornamentation under L.M.

Among the *Abstoma* species, *A.friabilis* is very close to *A.verrucisporum* Wright & Suárez (*loc.cit.*) due to its size, not spiralled capillitium and spores with a warty ornamentation. It differs by the frequently perforated capillitium and the smaller spores which are less coarsely ornamented.

ACKNOWLEDGEMENTS

This work has been possible as a joint agreement through a Research Project included in the Programa de Cooperación con Iberoamérica, Ministerio de Educación y Ciencia (MEC), Subdirección Gral. de Cooperación Internacional, Spain. A.Altés thanks the Ministerio de Educación y Ciencia for granting a fellowship for a brief stay at the Universidad de Baja California (Mexico).

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C.Ochoa thanks the Consejo Nacional de Ciencia y Tecnología de México (CONACYT) for granting a fellowship to undertake a Ph.D.thesis on the *Gasteromycetes* of Baja California (Mexico).

The authors express their gratitude to the curators of the herbaria BAFC, BPI and NY for the loan of their collections, to Drs. V.Demoulin and H.Kreisel for the revision of the manuscript and their suggestions about the new species, to Dr. F.Esteve-Raventós for revising the English text, and to Mr. A.Priego for his cooperation with the S.E.M.

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SPANISH MYXOMYCETES. V. A NEW SPECIES OF *BADHAMIA*, AND A NEW VARIETY OF *PHYSARUM*

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Abstract.- *Badhamia grandispora sp. nov.* is described and figured; it is characterized by its stalked sporophores with rugose peridium, pinkish colour and big dark spores with a remarkable ornamentation under the scanning electron microscope. *Physarum alpinum var. pallidosporeum* differs from *P. alpinum* in having distinctly paler spores.

For the terminology used we refer to DÖRFELT & MARX (1990).

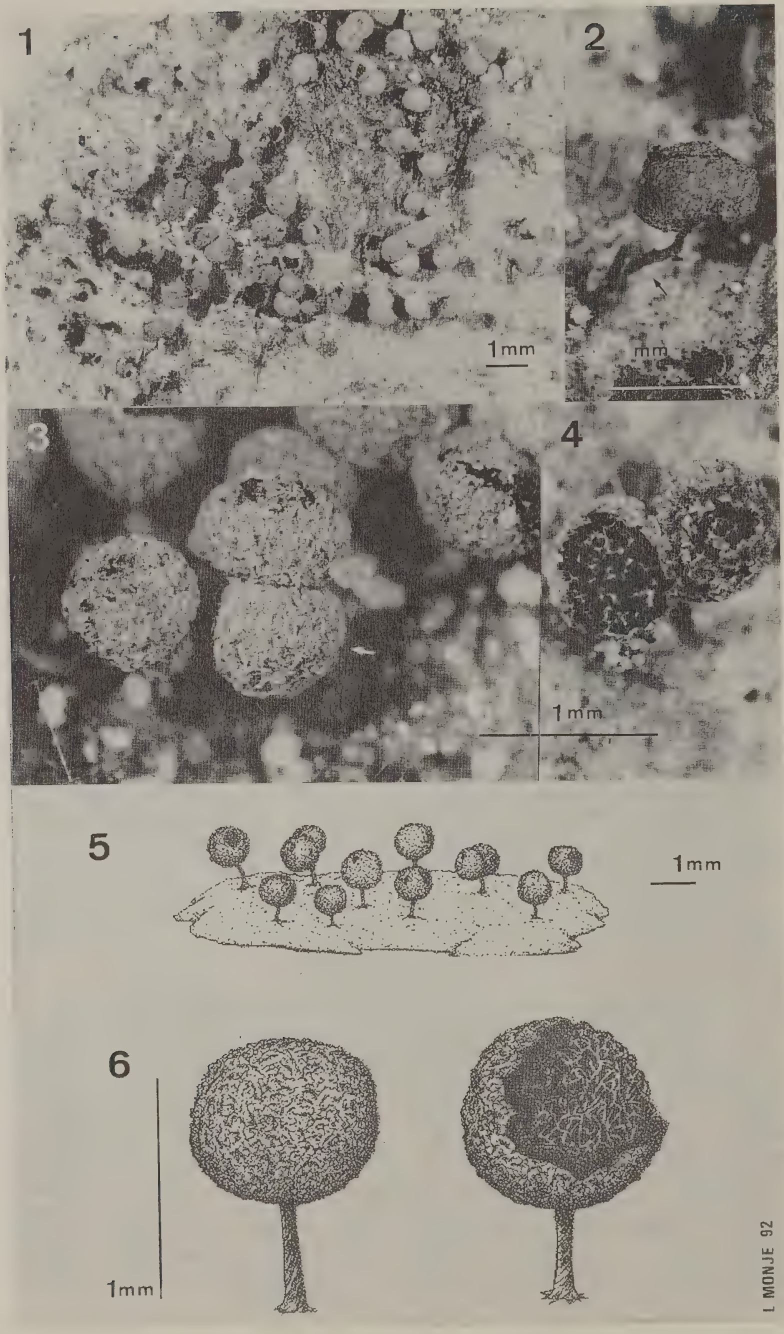
Badhamia grandispora Illana & Moreno, *sp. nov.* (Figs. 1-12)

Sporocarpia 0,5-1 mm diam. et 0,2-1,2 mm alta, gregaria, sola aut caespitosa, globatim 2-4 apparentia, globosa aut subglobosa, subter umbilicata, stipitata, raro sesilia. Stipes 0,1-0,2 mm altus, ruber. Peridium simplex, carneo-rosaceum, rugosum, multas venas et nullam columellam habens.

Capillitium calcareum, densum, "badhamioide", nodulos magnos inter se allis filamentis angustioribus iunctos habens. Sporae confertim nigrae, microscopio exploratae valde fuscae, 17-20 μm diam., valde angulosae, liberae, ornamentum parvis papillis constitutum.

Habitat: in cladodiis mortuis Opuntiae fici-indicae, Castellar de la Frontera (Cádiz), 14.XII.1990, leg. A. Ortega & C. Illana, Holotypus AH 13082 (Isotypus in herbarium privato Nannengae-Bremekamp sub nº 16.691).

Sporocarps solitary, scattered, gregarious or 2-4 clustered together, stalked, 0,2-1,2 mm tall. Sporophores 0,5-1 mm in diam., globose or subglobose, umbilicate below or with a limeless, dark, plicate basal cup with a thickened undulate margin, pale pinkish flesh coloured above. Hypothallus reddish translucent orange-red in transmitted light. Peridium veined, lime scarce and rather evenly deposited. Columella absent. Capillitium calcareous throughout, rather dense, with large limy parts connected by slender ones, lime globules 0,5-1 μm in diam. Spores black in mass, in transmitted light very dark brown, 17-20 μm in diam., strongly angular in optical section, with a lax reticulation of low ridges, very densely, very minutely papillose all over. Plasmodium not observed.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1mm
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mm
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5
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6
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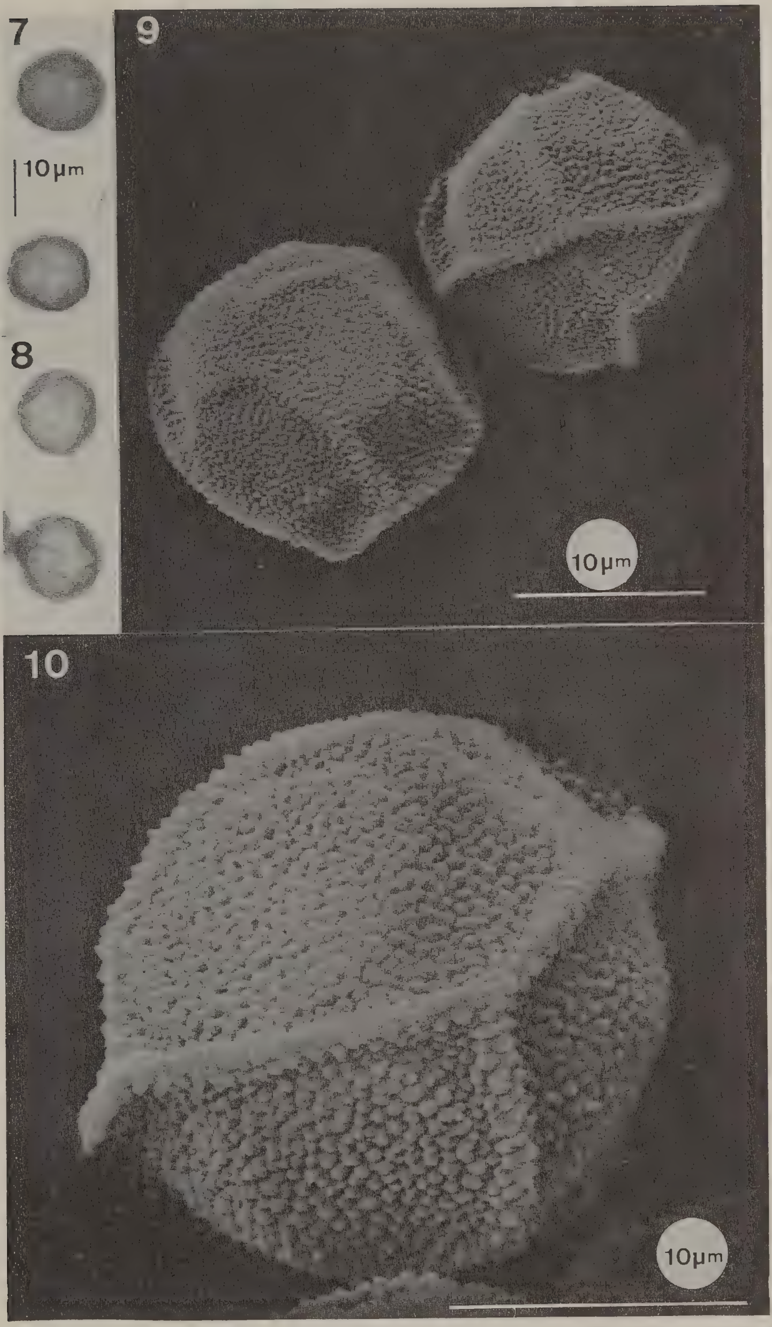
L MONJE 92

Figs. 1–6.– *Badhamia grandispora sp. nov.* 1 and 5: group of sporocarps, 2: stalked sporocarp, 3: rugose peridium, 4 and 6: open sporophores showing the capillitium.


7
10µm
8
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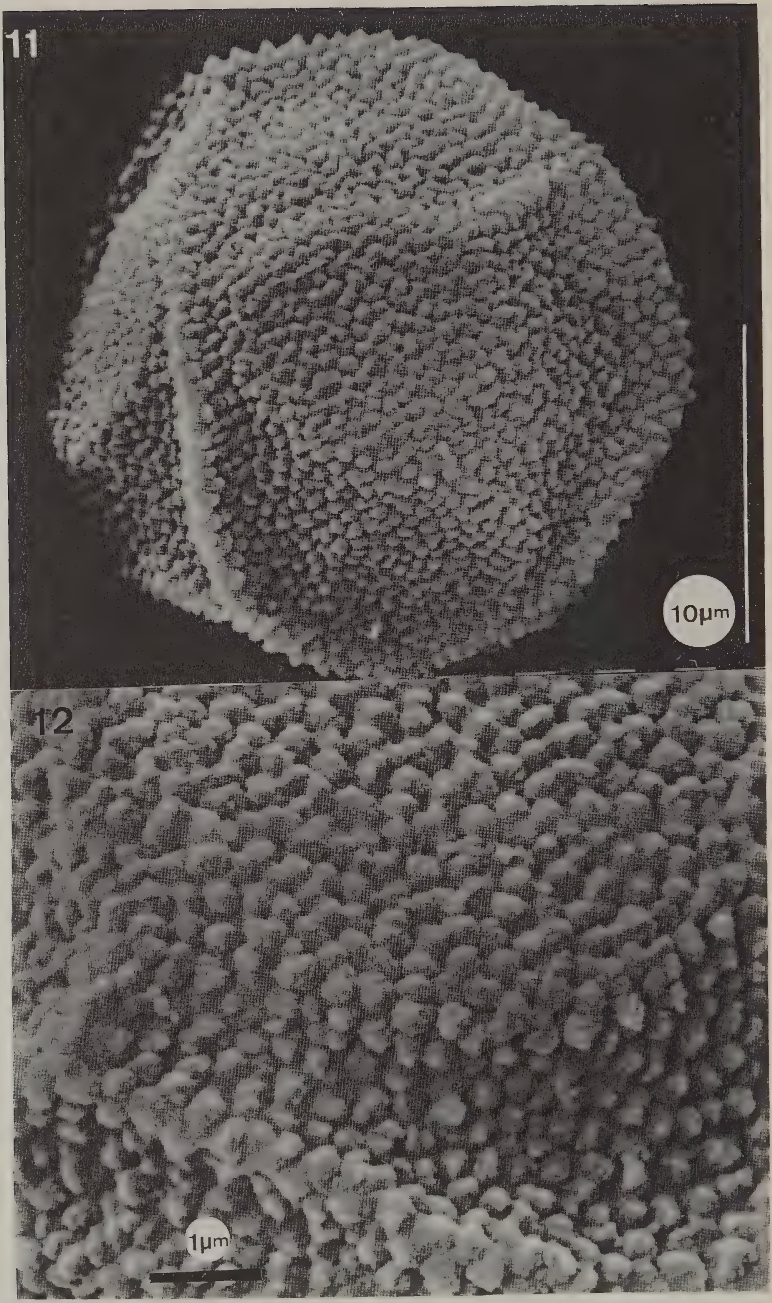
Figs. 7–10.– *Badhamia grandispora sp. nov.* 7-8: spores under the optic microscope. 9-10: spores under the S.E.M.


11
10µm
12
1µm

Figs. 11–12.– *Badhamia grandispora sp. nov.* Spores and detail of the warted ornamentation under the S.E.M.

Holotypus AH 13082, on dead cladodes of *Opuntia ficus-indica*, Castellar de la Frontera (Cádiz), 14-XII-1990, leg.: A. Ortega & C. Illana (*Isotypus* in the private herbarium of Nannenga-Bremekamp sub nº 16691). Although we only have one single collection, the latter consists of about 100 well-developed sporocarps.

B. grandispora is close to *B. gracilis* (T. Macbride) T. Macbride, *B. melanospora* Speg. and *B. rhytidosperma* Keller & Schocknecht. All these have large dark reticulate spores. It differs from all three in the very dense small papillae on the spores. *B. gracilis* can be distinguished by its white or pale grey colour and by its slightly smaller spores: 12-16 µm in diam., and by its ornamentation consisting of more scattered spines (SCHEETZ & ALEXOPOULOS, 1971; LIU 1990 ; *B. melanospora* by its yellowish rather flaccid stalks, and *B. rhytidosperma* by its spores which have small meshes when dehydrate, which on swelling desintigrates into free papillae, moreover it usually forms irregularly lobed, sessile plasmodiocarps.

Dead *Opuntia* cladodes are a good substrate for a number of *Myxomycetes*. Among these is *Physarum spectabile* Nann.-Brem., Lado & Moreno, which is like *B. grandispora* in its spore structure. In this feature *P. bubalinum* Farr (from dung) also resembles it. Both however are obviously *Physarum* species (capillitium), sessile and their spores are much smaller as well.

Because of its rugose peridium it may resemble *B. rugulosa* Brooks & Keller, a species described from moist chamber culture on wood of *Juniperus virginiana*, and which is also stalked, but with pale orange peridium and pale much smaller spores (KELLER & BROOKS, 1975).

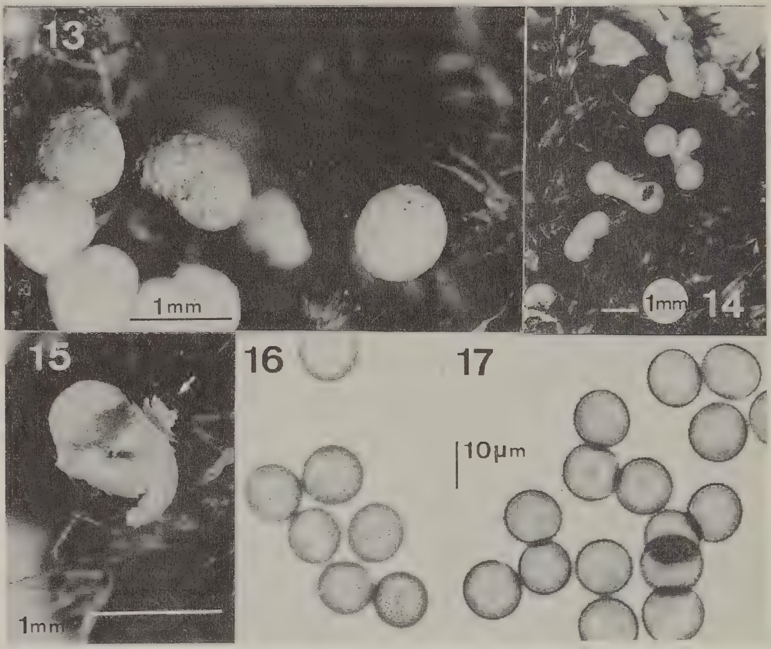
Physarum alpinum (A. & G. Lister) G. Lister **var.** ***pallidosporeum*** Illana & Moreno, ***var. nov.*** (Figs. 13-17)

Sporocarpia gregaria, sesilia 0,7-1,2 mm diam. Peridium duplex. Exoperidium luteo-citrinum, sedimenta calcarea parvis splenis patentia. Endoperidium adhaerens, membranosum, hyalino-cinereum. Capillitium magnos nodulos albidos habens, tenuibus filis iunctos.

Sporae nigrae confertim, brunneo-violaceae microscopio exploratae, verrucosae 10,5-12 µm diam. Plasmodium luteum.

Habitat: in bryopsidis corticicolis Quercus sp., in Quinta Cervantes, Alcalá de Henares (Madrid), 1.XII.1989, leg.: C. Illana, Holotypus AH 12331.

Sporocarps gregarious, sessile, 0,7-1,2 mm in diam. Peridium double, the exoperidium with a yellow-lemon colour, with calcareous deposits in small patches, adherent endoperidium, membranous, hyaline with greyish tints. Capillitium with large whitish nodes united by fine filaments. Spores black in mass, pale purple brown in transmitted light, warted, 10,5-12 µm in diam. Plasmodium yellow.



Figs. 13–17.– *Physarum alpinum* var. *pallidosporeum var. nov.* 13-14: sporocarps. 15: open sporophore showing both layers of the peridium. 16-17: spores.

Holotypus AH 12331, on bryophytes on piled wood of *Quercus* sp., Quinta Cervantes, Alcalá de Henares (Madrid), 1-XII-1990, leg.: C. Illana. Other specimens from the same locality, AH 12332. Same locality, on bark of *Quercus* sp. coming from piled trunks, in moist chamber from 15-II-1991 to 8-III-1991, AH 13126.

In the specimen obtained in a moist chamber, the spores are also pale brown, but it is not possible to distinguish the two layers of the peridium.

The description of *P. alpinum* has been modified recently by MITCHEL & al. (1986). This species was originally described as having sessile sporocarps of 1-1,3 mm in diam. or plasmodiocarps of 2-30 mm long. After studying the type collection, these authors noticed that under the name of *P. alpinum* there were two different taxa involved. On the one hand *P. alpinum* with sporocarpous fructifications, and on the other hand plasmodiocarpous ones which they considered as a new species: *P. alpestre* Mitchel, Chapman & Farr. Our collections agree with the description of *P. alpinum*, however, Nannenga-Bremekamp (com. pers.) pointed out to us that they differed in having remarkably paler spores, a character which proved to be constant in the various records made on different dates. Therefore we propose the new variety.

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EVIDENCE FOR A MYCORRHIZAL HOST SHIFT DURING MIGRATION OF LACCARIA TRICHODERMOPHORA AND OTHER AGARICS INTO NEOTROPICAL OAK FORESTS

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ABSTRACT

Specimens putatively identified as *Laccaria trichodermophora* were collected under *Quercus* in Costa Rica. These collections are contaxic and intercompatible with North American material of this taxon that occur under *Pinus*. Reports of several other agarics occurring under stands of neotropical *Quercus* that were previously known only from North American forests dominated by Pinaceae are consistent with this finding. These new reports of *L. trichodermophora* occurring under native oaks in Costa Rica are significant because representatives of this taxon and other taxa of *L. bicolor sensu lato* have been used extensively in mycorrhizal research utilizing north temperate Pinaceae.

Key Words: Agaricales, distribution, ectomycorrhizae, host specificity, intercompatibility, *Laccaria*, neotropics, Pinaceae, *Quercus*

Pinaceae occur natively only as far south as northern Nicaragua in the Western Hemisphere resulting in a drastic reduction of available ectomycorrhizal host tree species in most neotropical forests. Ectotrophic trees of montane forests of Costa Rica, Panama and Colombia are primarily limited to species of *Quercus* L. with scattered populations of *Alnus* B. Ehrh. and *Colombobalanus* Nixon & Crepet, the latter restricted to Colombia. In South America, *Quercus* and *Colombobalanus* occur natively only in Colombia, and the dominant ectotrophs in montane regions of other tropical South American countries are *Alnus* and *Salix* L. Ectotrophic trees in lowland neotropical forests belong primarily to the Gnetaceae, Leguminosae, and Sapotaceae (Singer *et al.*, 1983). Ongoing research in our lab and others has been investigating generic and species composition, distribution, degree of endemism, and potential host specificity of fungi forming ectomycorrhizae with species of *Quercus* in Costa Rica and Colombia (e.g., Halling and Ovrebo, 1987; Mueller, 1990).

Many areas in Central and South America, as well as other tropical and subtropical regions, have extensive pine plantations. These plantations have a unique mycota for southern Central and South America (Marx, 1980). We have found plantations of *Pinus radiata* D. Don (Monterey pine) dominated by the same ectomycorrhizal fungi in southern Chile, Colombia and Costa Rica. These fungi include *Suillus luteus* (L.: Fr.) S. F. Gray, *Lactarius deliciosus* (Fr.) S. F. Gray, and *Laccaria trichodermophora* G. M. Mueller. *Amanita muscaria* (L.: Fr.) Hooker var. *flavivolvata* (Singer) Jenkins is another commonly encountered exotic. Until recently, we had not seen unequivocal examples or reports of any of these fungi growing in forests of native trees.

On three recent trips to Costa Rica, we encountered several collections provisionally identified as *Laccaria trichodermophora* growing in forests dominated by *Quercus costaricensis* Liebmann. These sites were distant from any pine plantations. *Laccaria trichodermophora* has been reported only from pine or mixed pine/oak forests in the southeastern United States and Mexico (Mueller, 1992), as well as planted pine plantations throughout the Western Hemisphere. Similarly, several other agarics previously known only from forests dominated by Pinaceae in North America have been collected in Colombia and Costa Rica. Confirmation of the identity of these collections and a discussion of ecological and practical implications of these finds are presented below.

MATERIALS AND METHODS

Field work has been carried out in a number of sites in Costa Rica and Colombia by ourselves and others (see ACKNOWLEDGEMENTS). *Laccaria* specimens discussed in this paper are housed at F. Monokaryotic cultures were obtained following the techniques of Fries (1983) and Fries and Mueller (1984). All isolates from the same collection received the collection's number (stock) plus an isolate number provided as an extension (e.g., 3950.2). Costa Rican tester isolates, testers of North American material representing *L. trichodermophora*, and testers of other taxa of *L. bicolor sensu lato* employed in interstock pairing tests are listed in Table 1. Interstock pairing studies were undertaken following the techniques outlined by Mueller and Gardes (1991). All isolates for this study are housed in the mycological culture collection at Field Museum. Herbarium abbreviations are from Holmgren *et al.* (1990).

RESULTS

Specimens putatively identified as *L. trichodermophora* were collected at two sites under nearly pure stands of *Quercus costaricensis* at elevations over 3,000 m on Volcán Irazú, Parque Nacional Volcán Irazú, Provincia de Cartago, Costa Rica during three successive field trips. In all, 14 collections were made; GMM nos. 2460, 2461, 2478 & 2479 (3 August 1986); 3950-3952 (3 November 1989); and 4198, 4201-4205 & 4207 (17 July 1991).

Basidioma and somatic culture mat macro- and micromorphology of the Costa Rican material fit within the circumscription of *L. trichodermophora* (Mueller and Gardes, 1991; Mueller, 1992). Features of the Costa Rican material include moderate-sized basidiomata with pilei 20-40 mm broad and stipes < 55 mm long, reddish brown pileus and stipe color (7B6-7D8, Kornerup & Wanscher, 1978), flesh-colored to slightly vinaceous lamellae, violet but strongly hygrophanous mycelium at the stipe base, subglobose to broadly ellipsoid basidiospores that are typically < 8.5 µm long, and violet culture mat color on PDA, N6:5 and MMN media (Mueller, 1992).

Table 1. Geographical Origin and Disposition of Collections Used in Pairing Studies.

ID #[a,b]	Date	Country, State/Prov. County/Park	Herbarium
360	12.IX.82	SWED,Uppland, Uppsala	UPS
1591	3.X.82	SWED,Bohuslan, n. of Gothenburg	UPS
1744	16.IX.83	USA, NC, Jackson	TENN
1804	22.IX.83	USA, NC, Macon	F
1856	6.IX.84	USA, MI, Cheboygan	F, WTU
1882	10.IX.84	USA, MI, Cheboygan	F, WTU
1932	18.IX.84	CANAD, ONT, Algonquin Park	F, WTU
2013	18.X.84	USA, WA, Kittitas	F, WTU
2020	28.X.84	USA, WA, San Juan	F, WTU
2027	28.X.84	USA, WA, San Juan	F, WTU
2086	22.XI.84	USA, CA, Humbolt	F, WTU
2282	26.XI.85	USA, TX, Hardin	F
2306	29.XI.85	USA, TX, Polk	F
3950	3.XI.89	C.R., Cartago Volcán Irazú	F
3951	3.XI.89	C.R., Cartago Volcán Irazú	F
3952	3.XI.89	C.R., Cartago Volcán Irazú	F

[a] Collection 1744 is housed at TENN accessioned under TENN 44153.
[b] Collections 360 and 2086 were supplied by N. Fries and M. Seidl, respectively.

Tested stocks were intercompatible with each other (data available, not shown). All isolates of the tested Costa Rican stocks formed clamp connections when paired with the employed testers of North American *L. trichodermophora* and were intersterile with North American isolates representing other *L. bicolor sensu lato*, except for isolate 1856.3. Isolate 1856.3 was compatible with one isolate each of the Costa Rican stocks. Only one positive pairing was observed between Costa Rican isolates and Swedish testers; 3950.9 x 360.2. See Table 2 for the complete results of these tests.

DISCUSSION

Many fungi that form ectomycorrhizae apparently have restricted host ranges to some degree. This varies from extremes such as Suilloideae that are almost exclusively associated with Pinaceae (Singer, 1986) to genera such as

Table 2. Results of Intercollection Pairings with Costa Rican Isolates of *Laccaria trichodermophora* paired with North American and Swedish Testers of *L. trichodermophora*, *L. bicolor*, and *L. nobilis*[a].

	3950.2	3950.9	3951.1	3951.2	3952.2	3952.3
1744.2	+	+	+	+	+	+
1804.3	+	+	+	+	+	+
2282.6	+	+	+	+	+	+
2306.7	+	+	+	+	+	+
1856.2	-	-	-	-	-	-
1856.3	-	+	-	+	-	+
1882.1	-	-	-	-	-	-
1932.1	-	-	-	-	-	-
2013.1	-	-	-	-	-	-
2020.1	-	-	-	-	-	-
2027.2	-	-	-	-	-	-
2086.3	-	-	-	-	-	-
360.2	-	+	-	-	-	-
1591.2	-	-	-	-	-	-
1591.9	-	-	-	-	-	-

[a] Intercompatible pairings were identified by the formation of clamp connections and are represented by +; intersterile pairings did not form clamp connections and are represented by –. Each data point represents results from at least two replicate crosses. Stocks 1744, 1804, 2282 & 2306 are *L. trichodermophora* (North America); 1856, 1882, 1932, 2013, 2020 & 2027 are *L. bicolor* (North America); 2086 is *L. nobilis* (North America); and 360 & 1591 are *L. bicolor* (Sweden). See Table 1 for more geographical details.

Laccaria Berk. & Br. that have not been considered to be host specific. However, Mueller (1992) reported only three North American taxa, *L. amethysteo-occidentalis* G. M. Mueller, *L. proxima* (Boud.) Pat., and *L. laccata* var. *pallidifolia* (Peck) Peck, as appearing to be associated with both Fagaceae and Pinaceae. The other 17 recognized North American *Laccaria* appeared to be restricted to forests dominated by either Pinaceae or Fagaceae (Mueller, 1992). Likewise, systematic treatments of a number of genera with species that form ectomycorrhizae reported numerous taxa that appear to be associated with either Pinaceae or Fagaceae, but not both (e.g., Smith and Thiers, 1971; Singer, 1977; Hesler and Smith, 1979; Ovrebo, 1989). Although circumstantial, this evidence suggests that many agarics that form ectomycorrhizae are restricted to, or at least have a preference for, certain hosts.

This hypothesis is consistent with our developing knowledge of the mycota of neotropical oak forests. With few exceptions, ectomycorrhizal fungi reported to occur in both neotropical oak forests and North America have distributions that coincide with the distribution of Fagaceae in the Western Hemisphere. For example, none of the *Laccaria* reported exclusively from under Pinaceae in North America have been observed under native oaks except for *L. trichodermophora* (unpublished data). Similarly, Tulloss *et al.* (1992) did not recognize any North American taxa in their treatment of *Amanita* Pers. from the Colombian Andes. The sister taxa for most of their new taxa, however, appear restricted to eastern North America (Jenkins, 1986). Unfortunately, Jenkins (1986) does not discuss potential mycorrhizal associates for these taxa. Data on Costa Rican and Colombian *Lactarius* Pers. also follow this pattern with numerous undescribed taxa having been collected and the distribution of many of the named taxa overlapping that of Fagaceae in North America (personal communication, A. S. Methven, Eastern Illinois U., Charleston, IL). Finally, Singer *et al.* (1990, 1991) and Halling (1989) provided data on the Boletineae of the region. Their data fit the pattern seen in the previously discussed genera. In all of these studies, only a few taxa originally described as associated with Pinaceae and not Fagaceae have been encountered under neotropical oaks. These species include *Boletus pseudorubinellus* Smith & Thiers, *Laccaria trichodermophora*, and *Lactarius substriatus* A. H. Smith which were originally described as associated with spruce, pine and conifers in North America, respectively. Thus, while weakly host specific fungal species may be able to shift ectomycorrhizal partners in the absence of their presumed preferred host, evidence has not been found to indicate that agarics that exhibit strong host specificity can shift ectomycorrhizal partners.

A dramatic shift in ectomycorrhizal host has been invoked to explain widely disjunct distributions of species in several genera. Horak (1981, 1983) and Halling and Ovrebo (1987) hypothesized that *Rozites* Karsten originated and co-evolved with *Nothofagus* Blume in Gondwanaland and that the progenitors of Northern Hemisphere species either migrated along an Indomalayan land connection or rafted from Gondwanaland on the Indian tectonic plate. In either case, a shift in host from Nothofagaceae to Fagaceae and Pinaceae had to occur. Horak (1983) and Bougher and Malajczuk (1985) postulate a similar shift from association with *Nothofagus* to *Eucalyptus* L'Herit and other Myrtaceae during the evolution of *Descolea* Singer. Our data on *L. trichodermophora*, including the inter-compatibility of *Pinus* and *Quercus* associated collections from North America and Costa Rica, respectively, provide the most conclusive evidence yet that such host shifts can take place during migration.

Mueller and Gardes (1991) showed that *L. trichodermophora* could be distinguished from other *L. bicolor sensu lato* by its flesh color to only slightly vinaceous lamellae, scant mycelium at the base of the stipe, and less darkly pigmented basidiomata. It was shown to be intersterile with other species and to differ in mtDNA RFLPs (Mueller and Gardes, 1991). Interstock pairing studies proved useful for identifying intersterile, but morphologically similar populations. Material from these populations were then studied in detail in an attempt to identify distinguishing morphological characters (e.g., Mueller, 1991; Mueller and Gardes, 1991). Because of the subtle differences in basidioma characters that separate taxa in the *L. bicolor* complex, we subjected isolates of the Costa Rican collections to interstock pairing studies using testers of each of the taxa identified from North America and Sweden. The Costa Rican isolates of *L. trichodermophora* were fully compatible with North American material of this taxon and intersterile with the other taxa. The one isolate of *L. bicolor* (Maire) Ort. *sensu stricto*, 1856.3, that formed clamp connections with the Costa Rican isolates also mated with one of the North American *L. trichodermophora* isolates (Mueller and Gardes, 1991). Compatibility between taxa was very low among North American isolates with only 7.6% of the *L. bicolor sensu stricto* by *L. trichodermophora* pairings yielding clamp connections (Mueller and Gardes, 1991). Thus, data presented in this paper are consistent with published results on North American material.

The importance of ectomycorrhizal fungi in forest systems and for forestry practices has been well documented (e.g., Harley and Smith, 1983; Kropp and Langlois, 1990). However, only relatively few species of fungi have been used in the majority of laboratory, greenhouse and field studies on ectomycorrhizae (e.g., Trappe, 1977; Kropp and Langlois, 1990). *Laccaria bicolor sensu lato* and *L. laccata sensu lato* have been commonly used in such studies (e.g., Bryan and Zak, 1961; Marx and Zak, 1965; Molina, 1977; Trappe, 1977; Molina and Chamard, 1983; Kropp and Langlois, 1990) and are two of the taxa best known biologically (e.g., Fries, 1983; Fries and Mueller, 1984; Irving *et al.*, 1985; Kropp and Fortin, 1988; Doudrick and Anderson, 1989; Mueller and Gardes, 1991; Mueller, 1992). At the same time, little research has been carried out on the ectomycorrhizal behavior of neotropical *Quercus* (Marx, 1980). *Laccaria trichodermophora* may make a good tool for studying ectomycorrhizae of neotropical oaks since it has now been shown to occur in native oak forests and has proven useful in laboratory and field studies on ectomycorrhizae of Pinaceae.

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C. H. PERSOON: A PHANEROGAMIC FOOTNOTE

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While scanning the phanerogamic literature for descriptions of fungi on medicinal plants, I came across the following quote by R. M. Armstrong in DuToit (1980): "...I hold that the *Cannabis indica* is a distinct species, and not a variety of the *Cannabis S.* [*sativa*] as stated by Dr. Perciron."

Dr. Armstrong, a South African physician, offered this opinion to his Capetown medical society in 1855. DuToit questions the spelling of "Dr. Perciron." To me, this name suggests Christiaan Hendrik Persoon, another physician from South Africa, better known as a mycologist.

Persoon's contributions to phanerogamic botany are largely underappreciated. A perusal of Fungi on Plants and Plant Products in the United States (D. Farr *et al.*) finds Persoon cropping up in 57 plant names. Most of these taxa date to Persoon's two volume phanerogamic treatise, Synopsis Plantarum (1805-1807).

Data in Index Nominum Genericorum (E. Farr *et al.*) reveals Persoon erected 82 new phanerogamic genera. Forty of these generic taxa have maintained their priority; six are preserved as *Nomina Generica Conservanda,* as is Persoon's family name Cycadaceae (Greuter *et al.*).

Persoon also authored the 15th edition of Linnaeus's Systema Vegetabilium(1797). Many authors credit Persoon for introducing *subspecies* into the botanical literature (Clausen, 1941; Boivin, 1962; Davis & Heywood, 1963; Greuter, 1968). Previously, Linnaeus and others employed only one infra-specific category, the *variety.* Chater & Brummitt (1966) trace Persoon's first use of subspecies to Tentamen Dispositionis Methodicae Fungorum (1797). Weatherby (1942) suggests Persoon got the idea from Link, but Persoon's publication antecedes Link's first use of the term (in Philosophiae Botanicae, 1798) by one year.

In Synopsis Plantarum, Persoon marks varieties with Greek letters (a custom initiated by Linnaeus) and subspecies with an asterisk (*). Unfortunately, Persoon also uses asterisci to indicate "Speciebus obscuris aut quoad sedem dubiis, vel accuratiori indigationi subjiciendis." Thus an asterisk denotes either a subspecies or a dubious taxon requiring further investigation. Breistroffer (1942) accepts *all* names marked by an asterisk as Persoon subspecies. More conservative taxonomists only accept those taxa that Persoon clearly indicates have subspecific rank — Boivin (1962) recognizes five subspecies in

Synopsis Plantarum, Chater & Brummitt (1966) accept eleven. Greuter (1968) claims none of Persoon's subspecies are validly published.

Brizicky (1969) credits Persoon for introducing the taxonomic category *subgenus* in Synopsis Plantarum. Brizicky went so far as to propose that 1805 become the starting point for valid publication of plant taxa between the ranks of genus and species. [This proposal was rejected by the XI International Botanical Congress, Seattle.]

Returning to the *Cannabis* in Synopsis Plantarum, Persoon writes, “I. *sativa,* fol. digitatis. Lam. ill. gen. t.814. Hab. sponte in Persia,

β indica ◉ ” [◉ = annual plant]

Small & Cronquist (1976) thank Persoon for reducing *C. indica* Lamarck 1785 to a variety under *C. sativa* Linnaeus 1753 (kicking off a taxonomic debate which continues today). Yet they deny Persoon authorship, rejecting his variety as a *nomen nudum,* “... not published with any indication of being based on Lamarck's *indica.* ” I disagree: "Lam." clearly abbreviates Lamarck, and "ill. gen." refers to Lamarck's Tableau encyclopédique et méthodique Botanique, often cited by its subtitle, Illustration des genres. [Persoon erred here, Lamarck erected *C. indica* in Encylopédie méthodique Botanique I(2):695, but the ICBN does **not** invalidate pre-1953 recombinations containing bibliographic errors (see Greuter*et al.*, ICBN Art.33.2).] The debate continues.

ACKNOWLEDGEMENTS: Thanks to D Farr and E Farr for dredging their respective databases, and DP Rogers & RP Korf for reviewing the manuscript.

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Contribution towards a revision of the genera Camillea and Biscogniauxia (Xylariaceae, Ascomycetes) from Papua New Guinea.

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Abstract

In this study of *Camillea* Fr. and *Biscogniauxia* Kuntze in the rain forests of Papua New Guinea, the following taxa are recorded for the first time for the flora of Papua New Guinea : *Camillea tinctor*, *Biscogniauxia macula*, *B. nummularia* var. *exutans*, *B. nummularia* var. *merrillii*, *B. uniapiculata* and *B. uniapiculata* var. *macrospora*.
Hypoxylon maculum, *H. nummularium* var. *exutans* and *H. nummularium* var. *merrillii*, formerly placed in *Hypoxylon* sect. *Applanata* are newly combined in *Biscogniauxia*. A key to the species is provided.

Generic delimitation

In this paper one species of *Camillea* and six taxa of *Biscogniauxia*, all collected in the rain forests of Papua New Guinea are described.
The species now placed in the genera *Camillea* and *Biscogniauxia* constitute Miller's section *Applanata* of the genus *Hypoxylon* (Miller 1961) and the genus *Nummularia* Tul. & Tul. The turbulent history of these genera has now been well documented by Jong & Benjamin (1971), Eckblad & Granmo (1978), Pouzar (1979), Laessøe et al. (1989), and is summarized in table 1 and 2.
In 1979 Pouzar gave a more natural circumscription of the genus *Biscogniauxia* (8), not only based on external characters but also on microstructural ones. The main characters are :
- An applanate stroma, erumpent through bark. There is no ectostromal pigmentation (the aceton extract remains colorless).
- The perithecia are completely immersed.
- The ascospores are smooth, dark coloured, with a germ slit, and without a loosening perispore.
- The shape of the ascus apical apparatus is cubic - rectangular to more or

	Nummularia Tul. & Tul. 1863 s.l. (1a)	Nummularia Tul. & Tul. 1863 sensu Miller 1932 (1b)	Biscogniauxia Kuntze 1891 (2)	Kommamyce Nieuwland 1916 (3)	Numulariola House 1925 (4)	Hypoxylon Bull. ex Fr. 1849 sect. Applanata Miller 1961 (5)	Nummulariella Eckblad & Granmo 1978 (6)	**Obolarina** Pouzar 1986 (7)	**Biscogniauxia** Kuntze 1891 sensu Pouzar 1979 (8)		
									Sect. Biscogniauxia (a)	**Sect. Sclerester** Pouzar 1986 (b)	**Sect. Appendiculata** Whalley & Laessøe 1990 (c)
Biscogniauxia nummularia (Bull. : Fr.) Kuntze	LT : N. bulliardii Tul. & Tul. 1863 (isonym of Hypoxylon nummularium Bull. 1791) → Maire 1930 → Shear 1930 → Clements & Shear 1931 → Shear 1938 → Saccardo 1882 → Arx & Müller 1954	-	T : B. bulliardii (Tul. & Tul.) Kuntze 1891 (syn. : B. nummularia (Bull. : Fr.) Kuntze 1891)	T : K. bulliardii (Tul. & Tul.) Nieuwl. 1916	no type was indicated N. nummularia (Bull. : Fr.) House 1925 → Martin 1969	T : Hypoxylon nummularium Bull. ex Fr. 1849 (syn. : N. bulliardii Tul. & Tul. 1863)	-	-	T : B. nummularia (Bull. : Fr.) Kuntze 1891 → Pouzar 1979 → Callan & Rogers 1986 → Petrini & Müller 1986 → Granmo et al. 1989	-	-
Biscogniauxia marginata (Fr.) Pouz.	N. discreta (Schw.) Tul. & Tul. 1863	LT : N. discreta (Schw.) Tul. & Tul. 1863 → Miller 1932 → Rogers 1949 → Jong & Benjamin 1971	B. discreta (Schw.) Kuntze 1891	-	N. discreta (Schw.) House 1925	-	T : N. marginata (Fr.) Eckblad & Granmo 1978 (syn. : N. discreta (Schw.) Tul. & Tul. 1863)	-	B. marginata (Fr.) Pouzar 1979	-	-
Biscogniauxia repanda (Fr. : Fr.) Kuntze	N. repanda (Fr. : Fr.) Nits. 1867	N. repanda (Fr. : Fr.) Nits. 1867	B. repanda (Fr. : Fr.) Kuntze 1891	-	N. repanda (Fr. : Fr.) House 1925	-	N. repanda (Fr. : Fr.) Eckblad & Granmo 1978	-	-	T : B. repanda (Fr. : Fr.) Kuntze 1891	-
Biscogniauxia nothofagi Whalley, Laessøe & Kile	-	-	-	-	-	-	-	-	-	-	T : B. nothofagi Whalley, Laessøe & Kile 1990
Obolarina dryophila (Tul. & Tul.) Pouz.	N. dryophila Tul. & Tul. 1863	-	B. dryophila (Tul. & Tul.) Kuntze 1891	-	-	-	-	T : O. dryophila (Tul. & Tul.) Pouz. 1986	-	-	-

Table 1 : An outline of the generic names applied to *Nummularia*.

	Camillea Fries 1849 (9)	Nummularia Tul. & Tul. 1863 s.l. (1a)	Nummularia Tul. & Tul. 1863 sensu Miller 1932 (1b)	Numulariola House 1925 (4)	Jongiella Morelet 1971 (10)	**Camillea** Fr. 1849 sensu Laessøe, Rogers & Whalley 1989 (11)		**Lepreuria** Laessøe, Rogers & Whalley 1989 (12)
						subgenus Camillea (a)	**subgenus Jongiella** (Morelet) Laessøe, Rogers & Whalley 1989 (b)	
Camillea leprieurii (Mont.) Mont.	LT : C. leprieurii (Mont.) Mont. → Montagne 1855 → Clements & Shear 1931 → Dennis 1957	-	-	N. leprieurii (Mont.) Martin 1976	-	T : C. leprieurii (Mont.) Mont. → Laessøe et al. 1989	-	-
Camillea broomeiana (Berk. & Curt.) Laessøe, Rogers & Whalley	-	N. broomeiana (Berk. & Curt.) Starb. 1901 (as broomeana)	N. broomeiana (Berk. & Curt.) Miller 1932	N. broomeiana (Berk. & Curt.) Martin 1976	T : Jongiella broomeiana (Berk. & Curt.) Morelet 1971	-	T : C. broomeiana (Berk. & Curt.) Laessøe, Rogers & Whalley	-
Lepreuria bacillum (Mont.) Laessøe, Rogers & Whalley	C. bacillum (Mont.) Mont. 1855	-	-	N. bacillum (Mont.) Martin 1976	-	-	-	T : L. bacillum (Mont.) Laessøe, Rogers & Whalley

Table 2 : An outline of the generic names applied to *Camillea*.

less discoid (this in contrast to the ascus apical apparatus of *Camillea* species which is more vase- to urn-shaped, dome-shaped or somewhat diamond-shaped).

In 1986 Pouzar recognized two sections within the genus : 1) the sect. *Scleraster* (8b) characterized by stromata with a dentate margin and a basal region consisting of fungal tissue only, 2) the sect. *Biscogniauxia* (8a) in which the stromatal margin is smooth and where the basal stroma, if developed, is formed from a mixture of bark and fungal tissue, the ascospores are not appendaged.

The genus *Biscogniauxia* sensu Pouzar has since been accepted by Callan & Rogers (1986), Petrini & Müller (1986) and Granmo et al. (1989).

In 1990 the concept of the genus *Biscogniauxia* was extended to include some species formerly placed in *Hypoxylon* sect. *Applanata*. They are characterized by ascospores with a hyaline basal appendage. The stromata resemble those of the sect. *Biscogniauxia*. The new section *Appendiculata* Whalley & Laessøe (8c) was introduced (see Whalley et al. 1990a & 1990b).

The genus *Obolarina* (7) was created by Pouzar (1986) to accomodate the species *Nummularia dryophila* Tul. & Tul. 1863. The taxonomic position of the genus is still unclear (see Pouzar 1986).

The genus *Camillea* (11) was recently well described by Laessøe et al. (1989).

The main characters are :

- An applanate or cylindric stroma, erumpent through bark. There is no ectostromal pigmentation (the aceton extract remains colorless).
- The perithecia are completely immersed.
- The ascospores are light-coloured, ornamented, lacking germ slits, and without a loosening perispore.
- The shape of the ascus apical apparatus is vase- to urn-shaped, dome-shaped or somewhat diamond-shaped.

Also important to note is that *Camillea* species are known to have a *Xylocladium* Sydow anamorph while *Biscogniauxia* species have anamorphs referable to *Nodulisporium* Preuss, *Geniculosporium* Chester & Greenhalgh and *Periconiella* Sacc.

Within the genus two subgenera are recognized : 1) subgenus *Camillea* (11a) characterized by ascospores with a poroid, reticulate or ribbed ornamentation, and 2) subgenus *Jongiella* (11b) characterized by echinulate-verrucose ascospores.

The generic status of *Jongiella* (10) as proposed by Morelet (1971, 'n.s.') is not supported since the only difference with the genus *Camillea* lies in the kind of spore ornamentation (see Laessøe et al. 1989).

A new genus *Leprieuria* Laessøe, Rogers & Whalley (1989) (12) was erected to accomodate the species *Camillea bacillum* characterized by a cylindric stroma and glabrous, dark brown, reniform ascospores with prominent germ slits.

Since *Hypoxylon maculum*, *Hypoxylon nummularium* var. *exutans* and *Hypoxylon nummularium* var. *merrillii* possesses the cardinal features of *Biscogniauxia* (namely : - an erument applanate stroma, - no ectostromal pigmentation, - ascus apical apparatus discoid, - ascospores dark, smooth with a clearly visible germ slit and without a loosening perispore), and conform with type material we combine these names in *Biscogniauxia*.
Since the stromata have a smooth margin and the ascospores are not appendaged, *Biscogniauxia macula, Biscogniauxia nummularia* var. *exutans* and *Biscogniauxia nummularia* var. *merrillii* should be accomodated in *Biscogniauxia* section *Biscogniauxia*.

Up till now [except for *Biscogniauxia citriforme* var. *macrospora* (Van der Gucht & Whalley 1992)] there have not been any records of a *Biscogniauxia* or *Camillea* species for P.N.G. Neither have there been any records of a *Nummularia* species or a *Hypoxylon* species belonging to Miller's section *Applanata* reported (Van der Gucht & Van der Veken 1992).

Materials and methods

Most of the material studied was collected during an expedition, supported by the Belgian National Fund for Scientific Research (N.F.W.O.), in 1989. Other material was received on loan from the herbaria L and K.
Most of our material could be compared with specimens from BR, K and from the personal collection of A.J.S. Whalley (cited here as AJSW). The specimens from BR have been annotated by R.W.G. Dennis.
Our material was analysed based on observations with bright field and S.E.Microscopy.
Reagents used with bright field microscopy were Melzer, KOH (10 %) and aqua destillata. Drawings were made with the aid of a camera lucida.
For the analyses with the S.E.M., material was stuck on tape affixed to an aluminum stub, vacuum coated with gold and examined. The ascospores were air-dried first.
The cited collections have been deposited in the herbarium GENT.

Results

I. The genus *Camillea* subgenus *Camillea*.

Camillea tinctor (Berk.) Laessøe, Rogers & Whalley, Mycol. Res. 93 (2) : 145 (1989).

Descriptions and illustrations : Miller 1961 : 118-120, figs. 189-190, 223 (sub *Hypoxylon tinctor* (Berk.) Cooke) ; Dennnis 1964 : 236-237, fig. 5 (sub *H. tinctor* (Berk.) Cooke) ; Martin 1969 : 317-318, pl. IV: 1-3, 13 (sub *Numulariola* *tinctor* (Berk.) Martin) ; Laessøe et al. 1989 : 145-147, figs. 102-108, 130 (sub *Camillea tinctor* (Berk.) Laessøe, Rogers & Whalley).

Our material corresponds completely to the descriptions given by Miller (1961), Dennis (1964), Martin (1969) and Laessøe et al. (1989).
It is interesting to note that it is the only member of the genus found in Papua New Guinea. This is not surprising since the genus *Camillea* is almost exclusively confined to the Americas. *Camillea tinctor* together with *Camillea broomeiana* are the only members of the genus at present known from outside the New World. *Camillea tinctor* was already found both in Asia and Africa (Laessøe et al. 1989) and *C. broomeiana* from West Africa (Laessøe et al., 1989)
Also Rogers et al. (1987) in discussing Xylariaceae from North Sulawesi stated that 'The area in question seems devoid of *Camillea* species and applanate *Hypoxylon* species that would probably best be placed in *Camillea*.'

Specimens examined : PAPUA NEW GUINEA : MADANG PROVINCE : Hansa Bay, Laing Island, 4°10'S & 144°52'E, sea level, on dead wood of *Cordia subcordata* Lam. (Boraginaceae), 5.10.1989, Van der Gucht K. 89-559 (GENT). 24 km beyond the Ford (Naru River), 5°30'S & 145°28'E, elev. 500 m, on dead wood, 26.10.1989, Van der Gucht K. 89-1177 & 89-1205 (GENT). 25 km beyond the bridge over the Gogol River, 5°27'S & 145°32'E, elev. 250 m, on dead wood, 27.10.1989, Van der Gucht K. 89-1229a (GENT). Alexishafen, near the bridge on Biges River, on dead branch, 2.9.1990, Van der Veken P. 90-585 (GENT). Kamba, on dead wood, 25.8.1990, Van der Veken P. 90-355 (GENT).
MOROBE PROVINCE : Lae, Butibum Road, 6°43'S & 147°01'E, sea level, on dead wood, 15.10.1989, Van der Gucht K. 89-827b (GENT). Lae, 6°43'S & 146°53'E, elev. 140 m, on dead wood, 24.10.1989, Van der Gucht K. 89-1071 (GENT).

Reference material examined : ZAIRE : District Forestier Central, Yangambi, 00°46'S & 24°27'E, on *Celtis mildbraedii* Engl., Fassi B. 613, det. Dennis (BR). Eo loco, on *Xylopia sp.*, Fassi B. 715, det. Dennis (BR).

II. The genus *Biscogniauxia*

II.1. Section *Biscogniauxia*

Biscogniauxia citriforme* var. *macrospora Van der Gucht & Whalley, Mycol. Res. (1992).

Description and illustration : Van der Gucht & Whalley 1992 (in press).

A large spored variety of *Biscogniauxia citriforme* was described from Papua New Guinea (Van der Gucht & Whalley 1992).
Biscogniauxia citriforme is known from Nigeria (type locality) and Cameroon.

Biscogniauxia macula (Schw.) Van der Gucht K., comb. nov.

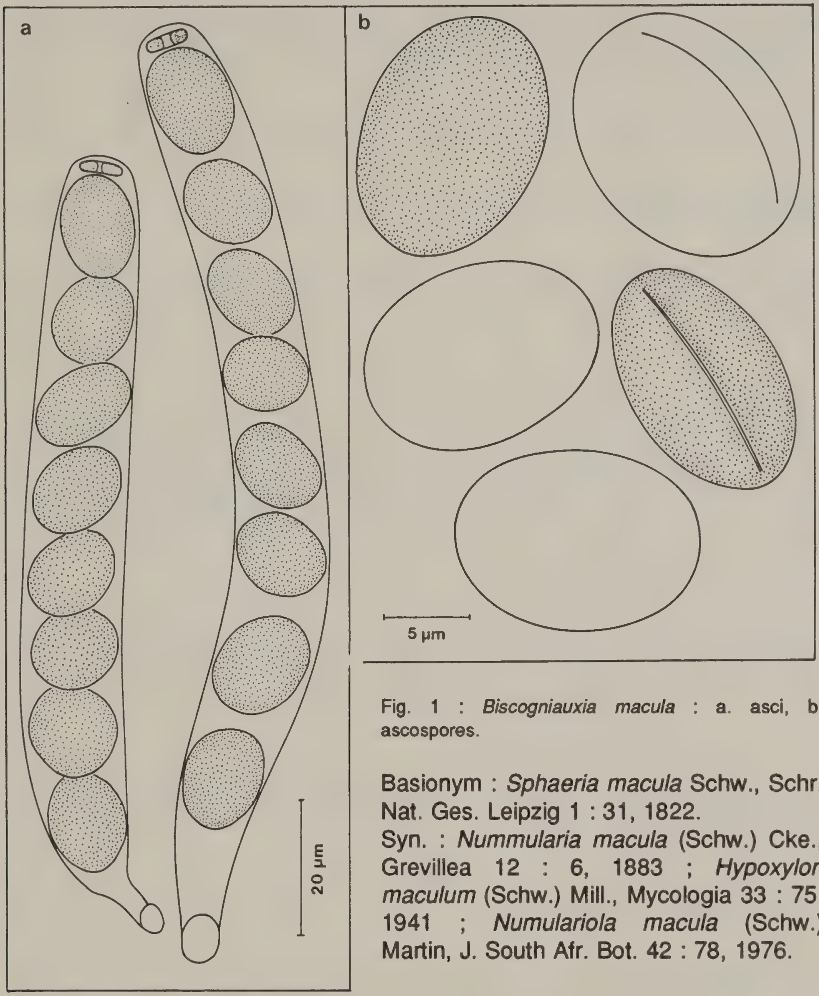


Fig. 1 : *Biscogniauxia macula* : a. asci, b. ascospores.

Basionym : *Sphaeria macula* Schw., Schr. Nat. Ges. Leipzig 1 : 31, 1822.
Syn. : *Nummularia macula* (Schw.) Cke., Grevillea 12 : 6, 1883 ; *Hypoxylon maculum* (Schw.) Mill., Mycologia 33 : 75, 1941 ; *Numulariola macula* (Schw.) Martin, J. South Afr. Bot. 42 : 78, 1976.

Descriptions and illustrations : Miller 1961 : 120, figs. 191, 224 (sub *Hypoxylon maculum* (Schw.) Mill.).

The examined material corresponds completely with the description given by Miller 1961 and is totally in agreement with the type collection.
Martin (1969 & 1976) did mention *Hypoxylon maculum* and transferred it to the genus *Numulariola*, no description was provided.

The asci are cylindrical, 8 spored, 110-145 x 14-15.5 µm (the spore bearing part 105-120 µm), apical apparatus discoid, blueing in Melzer's iodine reagent (see fig. 1a).
Ascospores uniseriate, almost globose, smooth, dark brown, 13.5-15 x 8.5-11.5 µm (avg. 13.8 x 10.1 µm). Germ slit straight running full length of the spore (see fig. 1b).

This species was up to now only found in southern U.S.

Specimen examined : PAPUA NEW GUINEA : MOROBE PROVINCE : Bulolo, in rain forest, Heads Hump, 1.2.1973, Horak E. N.G.180 (K).

Reference material examined : U.S.A. : ex Schweinitz herb., Cooke M1552, 1885 (TYPUS, K)

Biscogniauxia nummularia* var. *exutans (Cke.) Van der Gucht, comb. nov.

Basionym : *Diatrype exutans* Cooke, Journ. Linn. Soc. London 17 : 143, 1878.
Syn. : *Hypoxylon exutans* Cooke, Grevillea 8 : 66, 1879 ; *Anthostoma exutans* (Cooke) Sacc., Syll. F. 1 : 296, 1882 ; *Nummularia exutans* Cooke, Grevillea 12 : 8, 1883 ; *Hypoxylon nummularium* var. *exutans* (Cooke) Miller, World species of Hypoxylon : 124, 1961 ; *Numulariola exutans* (Cooke) Martin, J. South Afr. Bot. 35 : 304, 1969.

Descriptions and illustrations : Miller 1961 : 124-125, fig. 196 (sub *Hypoxylon nummularium* var. *exutans* (Cooke) Miller) ; Martin 1969 : 304-305, pl. III: 3 (sub *Numulariola exutans* (Cooke) Martin) ; Dargan & Singh 1986 : 411-413, figs. 1-7 (sub *H. nummularium* var. *exutans* (Cooke) Miller).

Our material corresponds completely to the description given by Miller (1961) and Dargan & Singh (1986). Martin (1969) gives a wide spore range : 10-16.5 x 4.5-9 µm of which the average is smaller than in our material i.e. 12.6 x 6.3 µm versus 13.25 x 6.19 µm.
The ascospores are ellipsoid to fusoid, smooth, dark brown with a straight germ slit running full length (see fig. 4).

Specimens examined : PAPUA NEW GUINEA : MADANG PROVINCE : Hansa Bay, Laing Island, 4°10'S & 144°52'E, sea level, on dead wood of *Diospyros maritima* Bl. (Ebenaceae), 5.10.1989, Van der Gucht K. 89-551 (GENT). Finisterre Range, 5°45'S & 145°35'E, elev. 150 m, on dead wood, 3.11.1989, Van der Gucht K. & De Meester L. 89-1494 (GENT).
MOROBE PROVINCE : Lae, 6°36'S & 147°02'E, elev. 300 m, on dead wood, 23.10.1989, Van der Gucht K. 89-1006 (GENT).
SOUTHERN HIGHLANDS PROVINCE : Mount Ambua, 6°S & 143°E, elev. 3000 m, on bark of tree, 9.8.1966, Kalkman C. 5122 (L).

Reference material examined : U.S.A. : Texas, Galveston Bay, on bark, Ravenel H.W. 76 (ISOTYPE, K)

ZAIRE : Equateur Province, Eala, 18°19'E & 00°03'N, on dead wood, sept. 1930, Staner 585, determinavit Dennis (BR).

One of our collections (Van der Gucht K. 89-1006) seems to be somewhat intermediate between this and the next taxon. The length of the spores is more in agreement with a *B. nummularia* var. *exutans* while the breadth is more like the one of *B. nummularia* var. *merrillii* : 11-13.5 x 4-6 µm (avg. 12.22 x 4.89) (see fig. 5).

Biscogniauxia nummularia* var. *merrillii (Bres.) Van der Gucht, nov. comb.

Basionym : *Nummularia merrillii* Bres., Hedwigia 56 : 307 (1915)
Syn. : *Hypoxylon nummularium* var. *merrillii* (Bres.) Miller, World species of *Hypoxylon* : 126, 1961 ; *Numulariola merrillii* (Bres.) Martin, J. South Afr. Bot. 35 : 303, 1969.

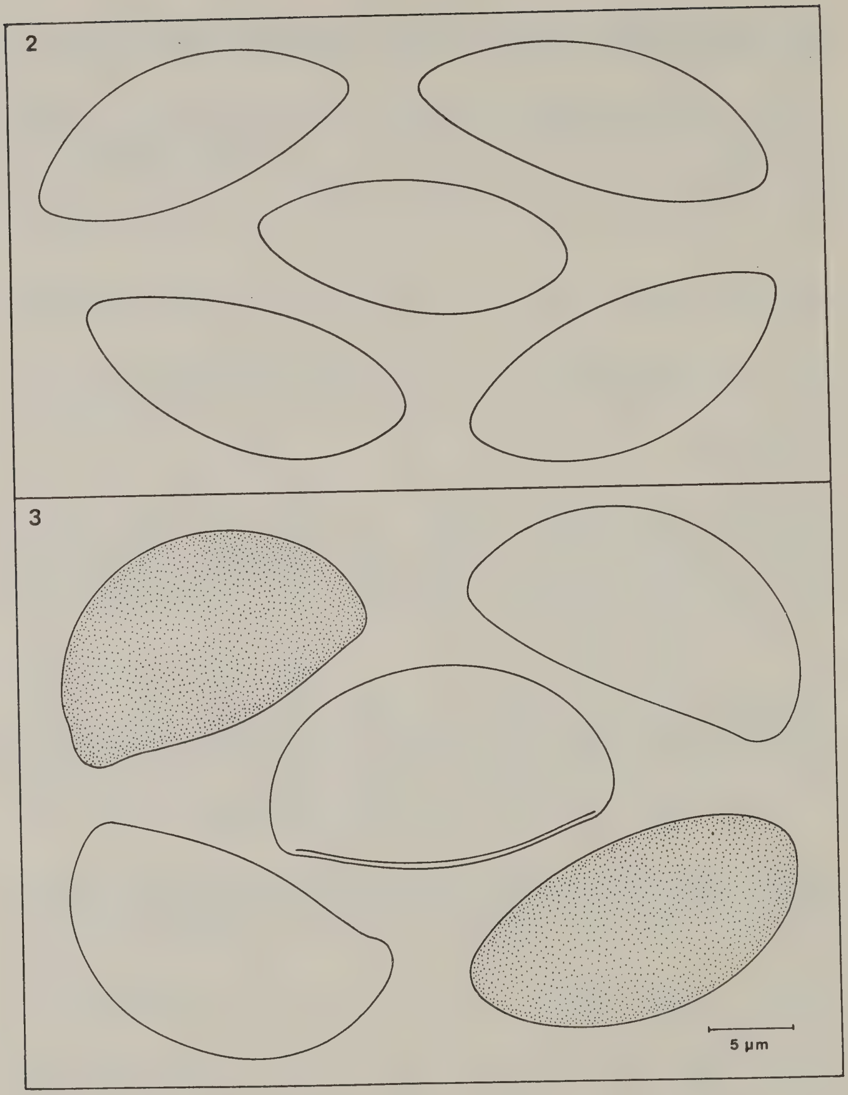
Descriptions and illustrations : Miller 1961 : 126, figs. 231-232 (sub *Hypoxylon nummularium* var. *merrillii* (Bres.) Miller) ; Martin 1969 : 303-304, pl. III: 8 & pl. IV: 4-5 (sub *Numulariola merrillii* (Bres.) Martin) ; Whalley & Taligoola 1976 : 97-98 (sub *H. nummularium* var. *merrillii* (Bres.) Miller) ; Pande 1973 : 12 (sub *H. nummularium* var. *merrillii* (Bres.) Miller).

Our material fits the descriptions given by Miller (1961), Whalley & Taligoola (1976) and Pande (1973). Martin (1969) gives a wide spore range : 8-17.5 x 4.5-9 µm and the average he mentioned is clearly larger than in our material : 13.4 x 6.5 µm versus 10.98 x 5.76 µm.
The ascospores are distinctively ellipsoid with rounded ends, smooth, dark brown with a straight germ slit running full length (see fig. 6).

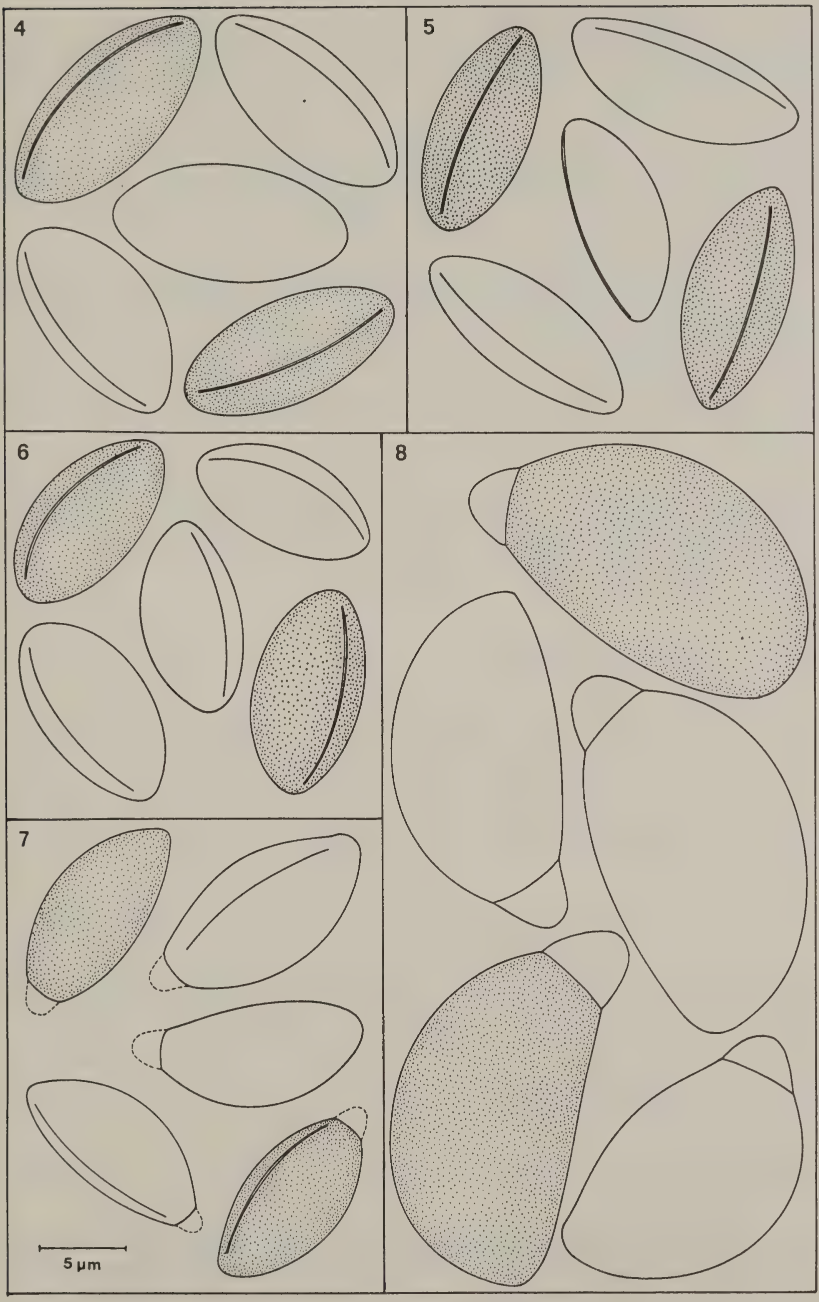
Specimens examined : PAPUA NEW GUINEA : EASTERN HIGHLANDS PROVINCE : Ukarumpa, 6°21'S & 145°56'E, elev. 1800 m, on dead wood, 14.10.1989, Van der Gucht K. 89-821 (GENT).
MOROBE PROVINCE : Lae, 6°36'S & 147°02'E, elev. 200 m, on dead wood, 9.11.1989, Van der Gucht K. & De Meester L. 89-1707 (GENT)

Reference material examined : PHILIPPINES : NEGROS : Canlaon volcano, april 1910, Merrill E.D. 6896, TYPE (K).
UGANDA : Mpanga Forest, 16.6.1973, Whalley 296, det. Whalley (AJSW).

Miller (1961) considered *H. nummularium* Bull. ex Fr. to be a polymorphic species. He recognized seven varieties based on the dimensions of the asci and ascospores.
Martin (1969) after examining both stromal and cultural characters of these varieties concluded that specific rank was justified. He then transfered them into the genus *Nummulariola* House.
However the only taxonomically valuable difference between the specimens we examined seems to lie in the dimensions and shape of the ascospores. This is in agreement with Miller (1961).



Figs. 2-3 : ascospores : 2. *Camillea tinctor*, 3. *Biscogniauxia citriforme* var. *macrospora*.
Figs. 4-8 : ascospores : 4. *Biscogniauxia nummularia* var. *exutans*, 5. *B.* cf. *nummularia* var. *exutans*, 6. *B. nummularia* var. *merrillii*, 7. *B. uniapiculata* (the hyaline appendage, lost in our material, is marked in a dotted line), 8. *B. uniapiculata* var. *macrospora*.


5 µm

II.2. Section *Appendiculata*

Biscogniauxia uniapiculata (Penz. & Sacc.) Whalley & Laessøe, Mycol. Res. 94 (2) : 239 (1990).

Descriptions and illustrations : Miller 1961 : 111-112, fig. 217 (sub *Hypoxylon uniapiculatum* (Penz. & Sacc.) Miller) ; Martin 1969 : 307-309, pl. III: 2, 7 (sub *Numulariola uniapiculata* (Penz. & Sacc.) Martin).

Our material corresponds to the descriptions given by Miller (1961) and Martin (1969). The ascospores are smooth, inaequilaterally ellipsoid with a straight germ slit running full length on the less convex side of the spore. However, most of our material was in a poor condition so that the spores had lost their appendage (see fig. 7).
Biscogniauxia uniapiculata was also reported from North Sulawesi (Rogers et al. 1987).

Specimens examined : MADANG PROVINCE : Hansa Bay, Laing Island, 4°10'S & 144°52'E, sea level, on rotten wood, 3.10.1989, Van der Gucht K. 89-508 (GENT). Finisterre Range, 5°24'S & 145°38'E, elev. 200 m, on dead wood, 22.10.1989, Van der Gucht K. 89-990 (GENT).
MOROBE PROVINCE : Lae, 6°36'S & 147°02'E, elev. 200 m, on dead wood, 9.11.1989, Van der Gucht K. and De Meester L. 89-1717a & 89-1693 (GENT)

Reference material examined : JAPAN : Yudomari - Kakushima island, Kagoshima Pref., 13.12.1979, Abe J. 26, det. Abe (AJSW).

Biscogniauxia uniapiculata* var. *macrospora (Rogers) Whalley & Laessoe, Mycol. Res. 94 (2) : 239 (1990).

Descriptions and illustrations : Rogers 1975 : 1061-1065, figs. 1-7 (sub *Hypoxylon uniapiculatum* var. *macrosporum* Rogers).

The specimen cited below is very much like *B. uniapiculata* var. *macrospora* as described by Rogers (1975), differing in its somewhat larger ascospores i.e. (16.5) 17-22 x 9-11.5 µm vs (14) 15-18 (20) x (6) 7-10 (11) µm. However the ascospores size is totally in agreement with the specimen found in North Sulawesi (cfr. 17.5-22 x 8.8-11.8 µm) (Rogers et al. 1987).

Specimen examined : PAPUA NEW GUINEA : MOROBE PROVINCE : Lae, 6°36'S & 147°02'E, elev. 200 m, on dead wood, 9.11.1989, Van der Gucht K. & De Meester L. 89-1715 (GENT).

Identification key

1a Ascospores dilute yellow, inaequilaterally - broadly fusiform, without a germ slit or pore (see fig. 2), 15-22 x (5.5) 6-8 µm. Appearing to be smooth by light microscopy but reticulate - poroid by S.E.M. Ascal plug urn shaped. ***Camillea tinctor***

1b Ascospores brown - black, smooth walled with a germ slit. Ascal plug discoid or cubic to rectangular. 2

- 2a. Ascospores with a hyaline appendage at one end or truncate when appendage has lost (see figs. 7 & 8). 3
- 2b. Ascospores not appendaged. 4

3a. Ascospores 10-12.5 x 5-6.5 µm (without appendages) ***Biscogniauxia uniapiculata***

3b. Ascospores (16.5) 17-22 x 9-11.5 µm (including appendages) ***B. uniapiculata var. macrospora***

- 4a. Ascospores subglobose, 13.5-15 x (8) 9-11.5 µm ***B. macula***
- 4b. Ascospores elliptic or lemon shaped, not subglobose. 5

5a. Ascospores lemon shaped (see fig. 3), (13) 15-19 (19.5) x (6) 7-11 µm. ***B. citriforme var. macrospora***

5b. Ascospores elliptic (see figs. 4, 5 & 6). 6

- 6a. Ascospores 12-15 (16) x 5-7.5 µm. ***B. nummularia var. exutans***
- 6b. Ascospores 10-12 x 5-6 µm. ***B. nummularia var. merrillii***

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MYCOTAXON

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NEW, RARE OR OTHERWISE INTERESTING LICHEN SPECIES FROM THE SIBERIAN ARCTIC

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ABSTRACT

Eighteen lichen species are reported from five localities in the Siberian Arctic. Seven species are new to the territory, and five of them are also new to Siberia, viz. Acarospora rhizobola (Nyl.) Alstrup, Arctopeltis thuleana Poelt, Lecanora geophila (Th. Fr.) Poelt, Lecidea atrofulva Sommerf. and Rhizocarpon pusillum Runem.

New records of the two amphi-Beringian species, Asahinea scholanderi (Llano) W. Culb. & C. Culb. and Dactylina beringica Bird & Thoms., represent considerable extensions to the west of these species. On the other hand Evernia mesomorpha Nyl. and Hypogymnia vittata (Ach.) Parr. were found very far to the north of Siberia. Rhizocarpon sp. is reported from a very unusual substrate: bare wood.

INTRODUCTION

From May to September 1989 the St. Petersburg Arctic and Antarctic Institute carried on investigations of the glacier and the vegetation on the Bennett Island in the East Siberian Sea. In the period June-August 1990 the Komarov Botanical Institute investigated the vegetation along the western coast of Taimyr Peninsula. During both of these expeditions M.P. Zhurbenko made extensive collections of lichens. E.S. Hansen revised the arctic lichen collections of M.P. Zhurbenko during a visit to the Komarov Botanical Institute in January 1992. The present paper deals with selected lichen species, which are considered of particular taxonomical or phytogeographical interest. The material studied is deposited in the Cryptogamic Herbarium of the Komarov Botanical Institute. Thirteen duplicates are deposited in the Botanical Museum, University of Copenhagen.

CLIMATE

The following meteorological data from Taimyr (T) and Bennett Island (BI) are based on information given by Treshnikov (1985):

1. Mean temperature of January: -27°C (T), -30°C (BI); July: +7°C (T), 0-+1°C (BI). 2. Amount of precipitation per year: 300-400 mm (T), 150-200 mm (BI). 3. Relative humidity of the air in January: 80-85% (T), 85% (BI); July: 80-85% (T), 95% (BI). 4. Wind velocity in January: 8.4 m/sek (T), 5.7 m/sek (BI); July: 6.2 m/sek (T), 6.0 m/sek (BI). 5. Annual balance of radiation: 10-15 kcal/cm^2 (T), 0-5 kcal/cm^2 (BI).

All of the localities are situated in the area covered by the last Arctic glacier, c. 18.000 years ago.

LIST OF LOCALITIES

The localities, where the present collections of lichens were made (see "List of species"), are indicated on the map (Fig. 1).

Locality 1. Mouth of Ragozinka river (72°48'N 80°53'E), coast of Eniseiskii Gulf, W. Taimyr, Siberia. The relief of locality 1, 2 & 3: maritime lowlands, alt. c. 0-20(40) m s.m.; moist plains intersected by watercourses, boggy depressions, stone-fields, more rarely basaltic outcrops (without calciferous contents).

Locality 2. Dikson Island (73°30'N, 80°19'E), coast of W. Taimyr, Eniseiskii Gulf, Cara Sea.

Locality 3. Mouth of Uboinaia river (73°39'N, 82°22'E), coast of W. Taimyr, Cara Sea.

Locality 4. Small basaltic mountain with the mark 217 m s.m. (73°25'N, 82°51'E), near the river Right Uboinaia, W. Taimyr.

Locality 5. Bennett Island (76°37'-76°45'N, 148°28'-149° 27'E), New Siberian Islands, archipelago De-Longa, East-Siberian Sea (max. length of the island is c. 28 km). Most of the island is occupied by a glacier (max. alt 384 m s.m.). The highest point of the island, a rocky cape, is 426 m s.m. Numerous colonies of birds occur on the coastal cliffs, which are red because of abundant occurrences of Xanthoria spp.) Otherwise the relief consists of maritime, coastal terraces up to c. 150 m s.m. and low accumulative terraces intersected by streams. Driftwood occurs scattered at the mouth of the rivers.

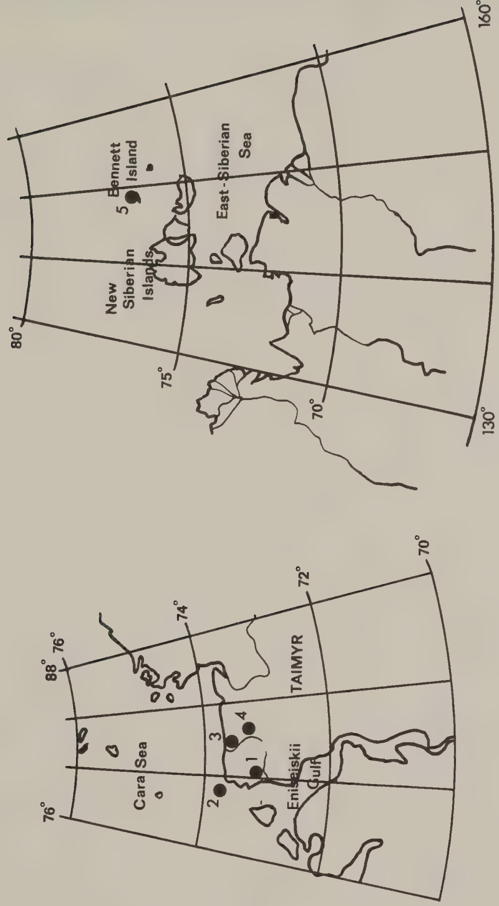
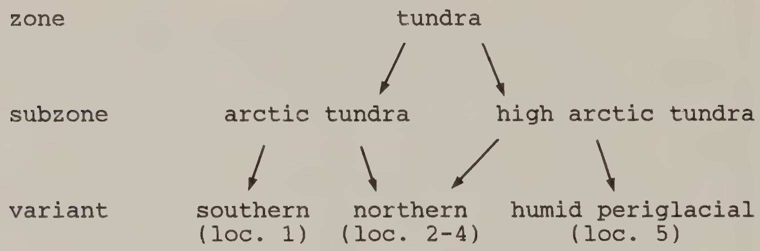

160°
80°
75°
70°
130°
Bennett Island
5
New Siberian Islands
East-Siberian Sea
88°
76°
74°
72°
70°
76°
TAIMYR
Cara Sea
Eniseiskii Gulf
1
2
3
4

Fig. 1. Location of the five localities in the Siberian Arctic.

VEGETATION

The following information on the vegetation around the five localities are compiled from Yurtsev, Tolmatchev & Rebristaja (1978):



The arctic tundra (loc. 1-4) consists of a mosaic vegetation of dwarf shrubs, herbs, mosses and lichens occurring in comparatively mesic habitats on the interfluves. Dryas punctata Juz. (= D. octopetala L. ssp. punctata (Juz.) Hultén), Salix polaris Wahlenb., Carex ensifolia (Gorodk.) V. Krecz. ssp. arctisibirica Yurtsev, Luzula nivalis (Laest.) Spreng. (= L. arctica Blytt), Hylocomium alaskanum (Lesq. et James) Aust. and Tomenthypnum nitens (Hedw.) Loeske are the dominant taxa. Grasses and mosses occur abundantly in the depressions in the tundra.

The southern arctic tundra-element (loc. 1.) occurs on S.-facing slopes in the form of herb-grass meadows and in valleys along streams, here as willow shrubs (Salix reptans Rupr. and S. lanata L.). The northern arctic tundras (loc. 2-4) are more poor in vegetation with fragments of meadows and willow shrubs, only. Bare, clayey and gravelly soil is more widely distributed in these tundras.

The high arctic tundra (loc. 5) is characterized by a very open and fragmentary, fell-field vegetation. It corresponds to the polar desert vegetation described by Aleksandrova (1980). About half of the area consists of bare, clayey or gravelly soil and stone fields. Mosses and lichens dominate in the plant cover, while vascular plants are very rare. The total number of vascular plant species occurring on Bennett Island does not exceed twenty. All plants, but especially the vascular ones, are characterized by a cushion-like lifeform.

The polygonal high arctic tundras can be subdivided into the following vegetation types: 1. A vegetation rich in herbs and mosses. 2. A vegetation consisting of herbs, dwarf shrubs and mosses. 3. A moss-lichen tundra. Papaver polare Tolm., Saxifraga oppositifolia L., Deschampsia brevifolia R. Br., Salix polaris Wahlenb., Ditrichum flexicaule (Schwaegr.) Hampe, Distichium capillaceum (Hedw.) B. S. G., Thamnolia vermicularis (Sw.) Schaer., Cetraria cucullata (Bell.) Ach. and Ochrolechia spp. are the dominant species.

LIST OF SPECIES

The following eighteen species are either new to the Siberian Arctic (apart from Novaya Zemlya), rare or otherwise interesting:

Acarospora peliscypha Th. Fr. (Syn. A. peliocypha (Wahlenb.) Arn.) - Loc. 1, on siliceous stone in stone field on the top of river bluff together with Candelariella vitellina (Hoffm.) Müll. Arg., Physcia dubia (Hoffm.) Lettau and Xanthoria candelaria (L.) Th. Fr., 2.7.1990, one specimen. - Loc. 4, on siliceous stone in stone field in tundra, 6.8.1990, one specimen.

A. peliscypha is an addition to the lichen flora of the Siberian Arctic. The species has previously been reported from Greenland, Iceland, Spitzbergen, Scandinavia and central Europe (Magnusson 1929, 1935; E.S. Hansen 1978). A. peliscypha is a nitrophilous species with a distinct preference for rocks and boulders influenced by dust or guano.

Acarospora rhizobola (Nyl.) Alstrup (Syn. Lecidea rhizobola Nyl.) - Loc. 4, on sandy soil in rock fissure in outcrop on small mountain (alt. c. 100-200 m s.m.) together with Psora rubiformis (Ach.) Hook., 5.8.1990, one well-developed specimen consisting of several, more or less confluent, ochreous squamules.

A. rhizobola is previously known from Greenland and Scotland (Alstrup 1986; Schneider 1979). In Greenland it is usually associated with more or less calciphilous lichen species such as Psora rubiformis and Toninia sedifolia Timdal. A. rhizobola is an addition to the lichen flora of Siberia.

Arctopeltis thuleana Poelt - Loc. 5, on vertical, S.-facing surface of basaltic coastal cliffs (alt. c. 140 m s.m.) together with Rhizoplaca melanophthalma (DC. in Lam. & DC.) Leuckert & Poelt and Xanthoria elegans (Link) Th. Fr., 9.8.1989, ten specimens.

A. thuleana is previously known from Greenland, Spitzbergen, Novaya Zemlya and the Canadian Arctic (Poelt 1983). Wainio's record of the species from Pitlekai (Wainio 1909) cannot be confirmed. Accordingly the species can be recorded as new to Siberia.

Asahinea scholanderi (Llano) W. Culb. & C. Culb. (Syn. Cetraria scholanderi Llano) - Loc. 1, on mosses on stone in stone field on the top of river bluff, 2.7.1990, one specimen. - Loc. 4, on soil, plant remains and stones together with mosses, 5.8.1990, three specimens.

A. scholanderi is previously known from North America (Thomson 1984) and the Siberian Arctic from Chukotka, where it is common, to Iakutiia (Rassadina 1971) and Taimyr (Piin & Trass 1971). The present specimens represent a big extension to the west of this "amphi-Beringian" species.

Caloplaca nivalis (Koerb.) Th. Fr. - Loc. 1, on Andreaea sp. over stone in stone field at the base of outcrop in tundra, 18.7.1990, one specimen.

The species has a wide distribution in Greenland (Hansen, Poelt & Søchting 1987), but is rare or overlooked in the Siberian Arctic (Malme 1932).

Catapyrenium daedaleum (Krempelh.) B. Stein. - Loc. 1, on dead mosses and soil on rock recess at the bank of river, 14.7.1990, one specimen. - Loc. 3, on dead mosses over sandy soil at the edge of coastal terrace (alt. c. 10-15 m s.m.), 11.8.1990, one specimen.

C. daedaleum is an addition to the lichen flora of the Siberian Arctic. It has previously been reported from Greenland, Iceland, Jan Mayen, Bear Island, Scotland, Fennoscandia, Karelia, Spitzbergen and Novaya Zemlya (Breuss & E.S. Hansen 1988).

Cladonia alaskana Evans - Loc. 1, 3 & 4, on stone field, in mires and in polygonal spotted tundra on interfluves, 1990, many specimens.

C. alaskana is known from Chukotka, Vrangel Island (Dobrysh 1992), New Siberian Islands (Makarova, Perfiljeva & Nikolin 1988), Iakutiia (Andreev 1984a), Belyi Island, Shokal'skogo Island (Andreev, Dobrysh & Rebristaja 1987). In addition M.P. Zhurbenko collected it in the northern taiga in the region of Sob'river in the Polar Ural. The species was previously considered as an amphi-Beringian element (E.S. Hansen & Tønsberg 1989), but now it appears to have a fairly wide distribution.

Dactylina beringica Bird & Thoms. - Loc. 1, on soil in herb-grass vegetation on S.-facing slope together with D. arctica (Richardson) Nyl. and D. ramulosa (Hook.) Tuck., 16.7.1990, one specimen, which represents a considerable western extension of the species in Siberia. Additional specimens are available from Chukotka, Vrangel Island, Iakutiia (Makarova & Perfiljeva 1984) and eastern Taimyr (personal communication with T. Piin). Thomson (1984) has mapped the distribution of D. beringica in North America.

Evernia mesomorpha Nyl. - Loc. 1, on drift-wood at the mouth of river, 5.7.1990, one specimen. - Loc. 4, on mosses over wind-exposed rock on the top of small mountain (alt. c. 200 m s.m.), 5.8.1990, three specimens.

These new specimens represent extreme northern disjunct occurrences of E. mesomorpha in the Siberian Arctic (compare with the single, isolated occurrence of the species at Myggbukta in North East Greenland (Thomson 1984)). E. mesomorpha has previously been found in Chukotka, Seniavina Bay (Almquist 1887; Nylander 1888), Iakutiia and at Kresty Taimyrskie (70°50'N, 89°01'E) in Taimyr (Piin 1984). The species is very common in the boreal and temperate part of North America, where it occurs on bark of Picea, Larix and Betula (Thomson 1984).

Hypogymnia vittata (Ach.) Parr. f. alpestris (Zahlbr.) Rassad. - Loc. 3 & 4, on wind-exposed, well-drained sites, such as tops of hills, edges of terraces growing on bare soil, gravel, mosses and plant remains, 1990, three specimens, det. R. Santesson.

H. vittata forms dense tufts. It is locally abundant. It is mainly an alpine and temperate species (Thomson 1984), which extends its distribution into the Siberian Arctic, for example, Chukotka, Iakutiia (Andreev 1984a) and Jamal Peninsula (Andreev 1984b). It has so far not been recorded from Greenland.

Lecanora geophila (Th. Fr.) Poelt - Loc. 3, on sandy soil and mosses on wind-exposed, well-drained, dry rocky bulges, for example tops of hills and edges of terraces (alt. c. 10-15 m s.m.) together with Parmelia omphalodes (L.) Ach. subsp. glacialis Skult, Pannaria pezizoides (Web.) Trevis. and Stereocaulon sp.

L. geophila is an addition to the known lichen flora of the Siberian Arctic (and to Russia). The species has previously been reported from the extremely high arctic part of Greenland (Qaanaaq) by E.S. Hansen (1989), who also recently collected it at Ittoqqortormiit and Uummannaq in central East- and West Greenland, respectively.

Lecidea atrofulva Sommerf. - Loc. 5, on stone on slope of coastal terrace (alt. c. 10 m s.m.), 23.7.1989, one specimen.

L. atrofulva is an addition to the known lichen flora of the Siberian Arctic. It appears to be common on rocks rich in iron minerals in Greenland (E.S. Hansen 1986). The Siberian specimen has orange red areoles, while the areoles of the Greenland specimens have a rusty red colour.

Pannaria hookeri (Borr. ex Sm.) Nyl. - Loc. 5, on stone and mosses on S.-facing, coastal cliffs (alt. 140-150 m s.m.) together with Physcia dubia, P. caesia (Hoffm.) Fürnrohr, Umbilicaria vellea (L.) Ach., Xanthoria candelaria and X. elegans, August 1989, two specimens. The species has also been collected in Chukotka, Taimyr and Vrangel Island. It is previously known from eastern North America and South West and South East Greenland (E.S. Hansen 1978).

Pertusaria solitaria H. Magn. - Loc. 4, on stones on small mountain (alt. c. 100-200 m s.m.), 5.8.1990, one specimen. The species is previously known from Novaya Zemlya, western Chukotka (Makarova 1979), Iakutiia (Makarewich 1971) and Lower Lena (Makarova 1989).

Phaeocalicium praecedens (Nyl.) Schmidt - Loc. 1, on branch of Salix reptans Rupr. in willow scrub on slope of hill, together with, e.g., Physcia aipolia (Ehrh. ex Humb.) Fürnrohr, 21.7.1990, one specimen (det. A.N. Titov). The species has previously been reported from Iakutiia (Titov 1986) and Canada (Ahti, Scotter & Vänskä 1973).

Rhizocarpon pusillum Runem. - Loc. 5, on Sporastatia testudinea (Ach.) Massal. on S.-facing coastal cliff (alt. c. 150 m s.m.), 7.8.1989, one specimen consisting of a few thalli, only.

R. pusillum has previously been reported from, for example, Greenland (E.S. Hansen 1984). Here it occurs even in the extremely high arctic Peary Land.

Rhizocarpon sp. - Loc. 5, on drift-wood at the mouth of Andreevskaia river (an unusual substrate for a yellow Rhizocarpon species), 1.8.1989, one specimen.

Rinodina cacuminum (Th. Fr.) Malme - Loc. 2, on stone on outcrop at the centre of the island (alt c. 20 m s.m.) together with Parmelia sulcata Tayl. and Xanthoria candelaria, 7.7.1990, one well-developed, fertile specimen.

Additional collections of R. cacuminum are available from western Chukotka, Iakutiia (unpublished data of I.I. Makarova) and Minin Island (Malme 1932).

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INDUCTION AND DESCRIPTION OF PERITHECIA OF CALONECTRIA SPATHIPHYLLI SP. NOV.

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ABSTRACT

A *Cylindrocladium*, now identified as *C. spathiphylli*, was frequently isolated from rotted heliconia roots in Florida. Pairing of isolates on irradiated *Howeia forsteriana* leaf segments on water agar or on propylene oxide-fumigated leaf segments of *Dianthus caryophyllus* on water agar yielded perithecia with appropriate mating types under normal laboratory conditions. *Calonectria spathiphylli* sp. nov. is proposed for the binomial of the heterothallic sexual state which is heretofore undescribed.

Key Words: *Calonectria spathiphylli*, *Cylindrocladium spathiphylli*, heliconia, *Ludwigia palustris*, spathiphyllum, *Strelitzia nicolai*.

INTRODUCTION

Since 1986, samples of heliconia with rotted roots have been received by the Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Gainesville for disease diagnosis. Isolations made from diseased roots frequently yielded a *Cylindrocladium* tentatively identified as *C. spathiphylli* Schoulties, El-Gholl, et Alfieri. Plant pathologists in Hawaii have also recently reported *Cylindrocladium* infections on heliconia roots and foliage (17). The purpose of this study was to confirm the identity of the *Cylindrocladium* from heliconia roots and to attempt induction of *Calonectria perithecia* (8,9).

METHODS AND MATERIALS

The following Florida isolates of a *Cylindrocladium* sp. from rotted heliconia roots were used in this study: P86-107, P86-210, HC-5, P87-167, P87-5157, 88-2, 88-3, 88-31, 88-32, P88-321, P89-249, P89-823, P89-1126 and P89-1685. These cultures are stored at the Florida Department of Agriculture and Consumer Services, Division of Plant Industry, 1911 S. W. 34th Street, Gainesville, Florida 32608-1201, U.S.A. Cultures were paired in all possible combinations on *Dianthus caryophyllus* L. (carnation) leaf segments on water agar (CL/WA) and on *Howeia forsteriana* (F. v. Mueller) Beccari (kentia palm) leaf segments on water agar (HL/WA) to enhance sporulation and promote perithecial formation (14). CL/WA was prepared as described by Fisher et al. (3). *Howeia forsteriana* leaf segments were sterilized with 2.5 megarads of gamma irradiation from a cobalt-60 source. CL/WA and HL/WA were prepared by placing several leaf segments in a sterile, plastic Petri dish (60 x 15mm), and pouring cooled (50°C), autoclaved water agar (WA) over the dried leaf segments which floated or became partially submerged.

To induce perithecia, *Cylindrocladium* mass cultures were paired on CL/WA and HL/WA and incubated for a period of 6 weeks at room temperature (25 ± 2°C) under normal laboratory conditions.

With sterile forceps, perithecia were picked and transferred to a drop of sterile deionized water (SDW) on a flamed slide. To remove conidial and mycelial contamination, perithecia were transferred through a series of individual drops of SDW. A sterile cover glass was placed on top of a drop containing the washed perithecia, and with pressure exerted against the cover glass, separated asci, asci in groups, and free ascospores were extruded. Asci and ascospores were washed off the slide with SDW into a sterile, plastic Petri dish (60 x 15mm). The suspension was then dispensed onto 1.8% WA in glass Petri dishes (100 x 15mm) and the excess was poured off. These plates were incubated at 18-20°C for a period of 16-20 h. Small squares of the WA containing single germinating ascospores were cut with a flamed scalpel under the dissecting microscope at x20 and were transferred to acidified potato dextrose agar (APDA) to compare colony morphology. APDA was prepared from the broth of 200 g of freshly peeled, diced, and boiled Irish potatoes supplemented with 20 g dextrose, 1 g KH_2PO_4, 18 g Difco Bacto agar, made up to 1 liter with deionized water, and adjusted to pH 4.3 with lactic acid after autoclaving.

Microscopic examinations and measurements were made on 247 perithecia, 107 asci, and 328 ascospores at x400 or x1000.

The *Cylindrocladium* anamorph from original heliconia isolates was also grown on dried, sterile peanut (*Arachis hypogaea* L.) stem pieces on 1.8% WA (PS/WA) to enhance sporulation (14). PS/WA was prepared by pouring cooled (50°C), autoclaved water agar over dried, propylene oxide-fumigated (4) pieces of peanut stem (4-6 cm

TABLE 1. Comparative conidial measurements (µm) of *Cylindrocladium spathiphylli* type culture with Florida *C. spathiphylli* isolated from heliconia roots.

Host isolate	Conidia measured	1-septate conidia % of total	2-septate conidia % of total	3-septate conidia % of total
Spathiphyllum:				
ATCC 44730	400	(45.0-)80.3(-101.0)x(5.0-)6.0(-7.0) 100%		
Heliconia:				
P86-107	253	(76.1-)107.7(-130.7)x(5.5-)7.3(-8.4) 36%	(89.5-)113.6(-144.1)x(5.9-)7.4(-8.9) 38.3%	(99.4-)114.9(-145.1)x(6.3-)7.5(-8.7) 25.7%
P86-210	179	(55.4-)80.3(-107.1)x(5.2-)6.1(-6.9) 37.4%	(67.3-)85.6(-110.1)x(5.5-)6.2(-6.9) 35.8%	(70.3-)83.3(-101.5)x(5.1-)5.9(-6.6) 26.8%
HC-5	209	(60.9-)83.0(-110.3)x(5.3-)6.4(-7.9) 89%	(84.5-)94.4(-104.4)x(6.5-)7.2(-7.9) 9.1%	(87.0-)95.3(-109.3)x(6.9-)7.1(-7.3) 1.9%
P87-167	107	(55.4-)80.7(-99.4)x(5.0-)5.8(-6.9) 100%		
P87-5157	188	(68.3-)90.0(-107.0)x(5.3-)5.9(-6.4) 24%	(81.2-)99.0(-115.8)x(5.1-)5.9(-6.4) 43.6%	(86.1-)100.7(-125.7)x(5.1-)5.9(-6.4) 32.4%
88-2	191	(57.4-)93.4(-119.3)x(5.9-)6.6(-7.3) 50.8%	(82.2-)103.6(-129.2)x(6.0-)6.7(-7.2) 36.1%	(86.1-)103.5(-119.8)x(6.1-)6.7(-7.0) 13.1%
88-3	172	(53.5-)86.6(-107.9)x(5.0-)6.0(-7.0) 61%	(83.7-)95.1(-140.6)x(5.2-)6.0(-6.9) 32.6%	(75.2-)95.3(-105.9)x(5.9-)6.2(-6.9) 6.4%
P88-321	303	(57.4-)86.5(-107.9)x(5.5-)6.4(-7.0) 66%	(81.7-)93.3(-110.9)x(5.9-)6.6(-7.1) 26.7%	(85.1-)94.6(-105.0)x(5.6-)6.6(-7.0) 7.3%

long) floating on WA or partially submerged in solidified agar. Conidiophore branches, phialides, and vesicles were mounted in water and were measured within 5 minutes of preparation. Conidia produced on the peanut stem were mounted in cotton blue lactophenol. All these measurements were made with the oil immersion lens at x1000.

Isoenzyme and protein electrophoresis were used as a further tool in distinguishing *C. spathiphylli* from species of *Cylindrocladium* that produce globose, subglobose, or sphaeropedunculate, apical vesicles (5,13). Cultures HC-5, P86-107, P86-210, and P87-167 (from heliconia), ATCC 44730 (from spathiphyllum), *C. floridanum* Sobers & C. P. Seymour (UFV-7A) from *Prunus persica* (L.) Batsch, *C. citri* (H. Fawc. & L. J. Klotz) Boedijn & Reitsma (UFV-2A, obtained from Dr. C. S. Tan-CBS18636), and *C. crotalariae* (C. A. Loos) D. K. Bell & Sobers (UFV-5A, from *Uncaria gambir* (Hunter) Roxb., obtained from Dr. F. Albuquerque, Belém, PA, Brazil) were compared. These cultures were grown on PDA at 26 ± 1°C in the absence of light for 4 days. Mycelial agar plugs were taken from the margins of actively growing colonies and were transferred to a semi-synthetic liquid medium containing 10 g sucrose, 2 g L-asparagine, 2 g yeast extract, 1 g KH_2PO_4, 0.1 g $MgSO_4.7H_2O$, 0.44 mg $ZnSO_4.7H_2O$, 0.48 mg $FeCl_3$, 0.31 mg $MnSO_4.H_2O$, and made up to 1 liter with distilled H_2O. Four agar plugs were placed in each of three 125 ml Erlenmeyer flasks containing 50 ml of the liquid medium and were incubated at 26 ± 1°C in the dark for 7 days. The mycelium was then harvested by suction onto Whatman No. 1 filter paper and was rinsed under vacuum with distilled water to remove any residual liquid medium.

For soluble protein extraction, 300 mg of the mycelial cake was placed in a centrifuge tube containing 1 ml of extracting solution (0.06 M Tris-HCL), immediately frozen in liquid nitrogen, and then ground in cold acetone in the presence of liquid nitrogen in a Polytron Homogenizer (Brinkmann Instruments, Westbury, NY). Grinding the mycelium in cold acetone was necessary to maximize resolution of sodium dodecylsulfate (SDS)-proteins of the isolates under study. During grinding, the centrifuge tube containing the sample was kept in an ice-bath. The extracts were maintained overnight at 10°C and were centrifuged at 40,000 x g for 30 minutes at 4°C. The supernatant was collected and stored at -20°C until used. For electrophoresis, protein extracts were mixed in equal amounts with sample buffer (25 ml glycerol, 0.06 M Tris-HCL solution, pH=6.8, 2.5 mg bromophenol blue dye, and 25 ml distilled water), and 50 µl of each sample was applied on the gel. Discontinuous polyacrylamide gel electrophoresis (PAGE) for native and denatured proteins and enzymes was performed as described by Alfenas et al. (1).

RESULTS AND DISCUSSION

Individual *Cylindrocladium* isolates from rotted heliconia roots did not produce perithecia on CL/WA or HL/WA. By pairing the isolates in all possible combinations, we were able to induce perithecia (Fig. 1) in some cases; initially on CL/WA, later on HL/WA. Propylene oxide fumigation did not effectively sterilize the *H. forsteriana* leaf segments. Leaf segments were therefore irradiated. HL/WA was found to be a better medium for perithecial production and was used throughout this study.

Perithecia were slow-maturing and sometimes required 6 weeks for ascospore formation. They were produced on the leaf segments and/or were embedded in the agar. Mature, embedded perithecia contained asci and ascospores, the same as mature perithecia which were formed on the leaf segments. Perithecial yield varied from experiment to experiment, and ascospore yield was generally low. Matings which produced perithecia with viable ascospores were: P86-210 x P87-167, HC-5 x P87-167, P87-167 x 88-2, P87-167 x 88-3, P87-167 x 88-31, P87-167 x 88-32, P87-167 x P88-321, P87-167 x P89-249, P87-167 x P89-823, and P87-167 x P89-1126. In all cases where perithecia were produced, isolate P87-167 was present. From the induced perithecia, we were able to establish cultures from single ascospores. Unpaired thirty single ascospore cultures obtained from P86-210 x P87-167 did not produce perithecia on CL/WA or HL/WA. On APDA, growth rate, colony morphology and sporulation varied greatly among the single ascospore isolates. Five monoascospore cultures which produced conidia abundantly on APDA (Fig. 2) were paired in all possible combinations on CL/WA and HL/WA. Some combinations produced perithecia with viable ascospores within 6 weeks. The fungus is therefore a heterothallic species. The isolates fell into two (+/-) sexual compatibility groups, indicating bipolar sexual compatibility.

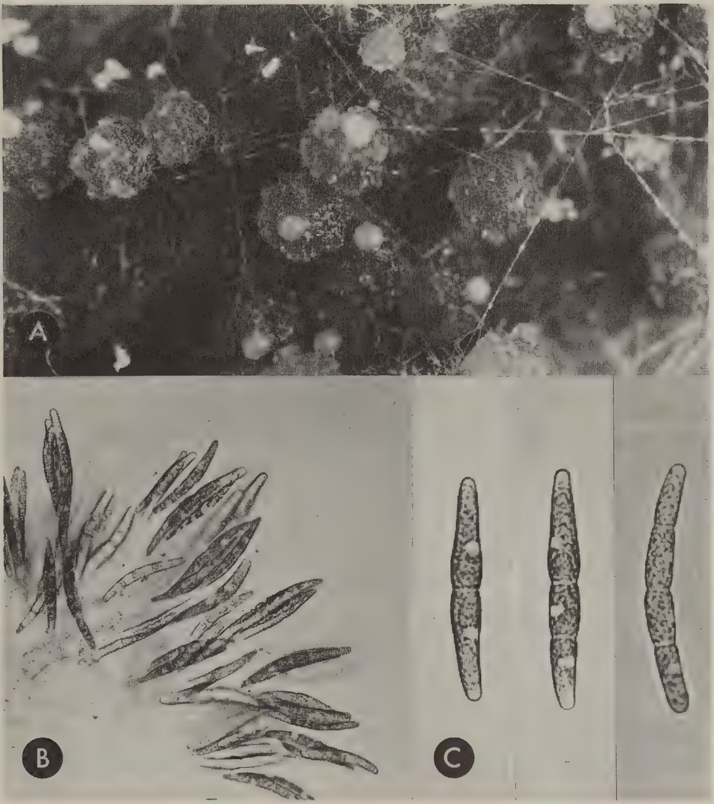

Fig. 1. *Calonectria spathiphylli.* A) Perithecia obtained from P87-167 (S+) x P86-210 (S-) on HL/WA x28. B) Asci x289. C) 1-, 2- and 3-septate ascospores x578.

Morphologically, the *Cylindrocladium* from heliconia is indistinguishable from *Cylindrocladium spathiphylli* Schoulties, El-Gholl, et Alfieri, a very destructive pathogen on commercial spathiphyllum (11,16). They both produce capitate (5) vesicles. No other known species of *Cylindrocladium* produces such a vesicle shape. The usefulness of vesicle morphology as a taxonomic criterion has been discussed by many authors. Bell and Sobers (2), Sobers and Seymour (15) originally proposed vesicle morphology as a useful feature in their comparison of *Cylindrocladium crotalariae, C. floridanum, C. scoparium* Morgan and others. Other useful morphological features besides vesicle morphology are conidiophore branching, conidial size and septation, phialide shape and size, and characteristics of the teleomorph, if produced. Hunter and Barnett (6) and Rossman (10) considered vesicle morphology too variable to be of any taxonomic value, and stressed instead conidial characteristics as of primary taxonomic importance. Peerally (7) and Uchida and Aragaki (18), however, recognized that though vesicle morphology could be subject to some variation, it was not so variable as to disqualify it as a valuable character in distinguishing species of *Cylindrocladium*. This claim is substantiated by recognizable differences in soluble protein and isoenzyme electrophoresis profiles of *Cylindrocladium* species which have superficially similar but distinct vesicle, conidium, and conidiophore morphology. We conclude that all features relating to conidium and conidiophore morphology, including shape and size of the vesicle, are useful and practical taxonomic characters when used judiciously with fresh isolates of *Cylindrocladium* species. Cultures from long term storage often produce abnormal conidia and vesicles and should not be utilized in systematic and physiological studies.

Matings were made on HL/WA between *Cylindrocladium* isolates from heliconia (primarily P87-167) and various *C. spathiphylli* from spathiphyllum, including type culture ATCC 44730. These matings produced perithecia with viable ascospores in some cases. P87-167 produced fertile perithecia when mated with the following *C. spathiphylli* isolates from spathiphyllum: ATCC 44730, P90-689, P90-1113, P90-1425, P90-3700, P91-180, P91-5033, P91-5168, and P91-5968 (all from Florida). Morphological similarity and sexual compatibility are consistent with the concept that this *Cylindrocladium* from heliconia and *C. spathiphylli* are conspecific. P87-167 also produced fertile perithecia when mated with *C.*

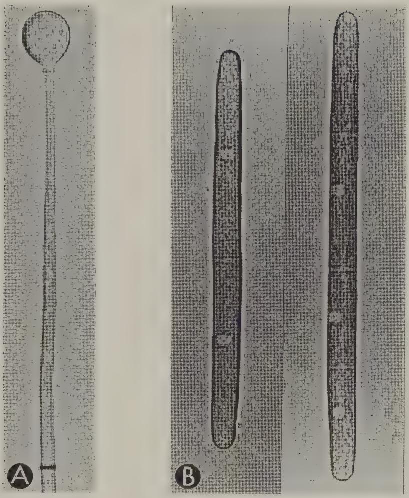

Fig. 2. *Cylindrocladium spathiphylli*. A) Capitate vesicle x578. B) Conidia from a monoascospore culture obtained from P87-167 (S+) x P86-210 (S-).

spathiphylli isolates from Hawaii which were obtained from roots of heliconia and spathiphyllum. In addition, P87-167 also produced fertile perithecia when mated with *Cylindrocladium* culture P91-1735 which was isolated in Florida from roots of *Strelitzia nicolai* Regel & Körn. A *Cylindrocladium spathiphylli* culture P91-7693 was also obtained from rotted basal stems of *Ludwigia palustris* (L.) Elliott. This expands the host range of *C. spathiphylli* to four genera: *Heliconia*, *Ludwigia*, *Spathiphyllum*, and *Strelitzia*. P87-167 was designated as mating type S+. The type culture ATCC 44730 (S-) successfully mated with the following spathiphyllum isolates from Florida: P90-997, P90-1987, P90-2709, P90-3251, P90-3590, P91-3920, P91-4778, P91-4937, P91-5166 and with two *C. spathiphylli* isolates from Hawaii: 1442 (from heliconia) and 1795 (from spathiphyllum).

Cylindrocladium cultures from heliconia (HC-5, P86-107, P86-210, and P87-167) and spathiphyllum (ATCC 44730) displayed nearly identical SDS-protein banding patterns, but were different from those of *C. floridanum*, *C. citri* and *C. crotalariae* (Fig. 3. A & B). The isolates from heliconia and spathiphyllum showed nearly identical major bands of non SDS-proteins (Fig. 3. C). Gels stained for α-isoesterases showed a region of common bands for the *Cylindrocladium* cultures from heliconia and spathiphyllum, but the banding patterns of *C. floridanum*, *C. citri* and *C. crotalariae* were different (Fig. 3. D).

In Florida, the *Cylindrocladium* from heliconia has 1- to 3-septate conidia (Tables 1 & 2) and a filament usually terminating in a capitate vesicle. Even though ellipsoid to spathulate, or subglobose (5) vesicles were present in most isolates (18), the dominant mature vesicle shape was capitate measuring (7.9-)14.3(-19.8) µm in diameter. Two hundred and twenty four vesicles were measured. Primary branches were nonseptate (18.8-)31.7(-39.6)x(4.3-)5.5(-6.9) µm or 1-septate, (30.7-)55.0(-71.3)x(4.8-)5.5(-6.3) µm. Secondary branches were nonseptate (10.9-)23.5(-36.1)x(4.0-)5.0(-6.4) µm or rarely 1-septate. Tertiary branches were nonseptate, (10.9-)17.6(-30.7)x(4.0-)5.2(-6.4) µm. Of 295 branches measured, only one quaternary branch was observed, 11.9 x 4.2 µm. Phialides were doliiform, cylindrical, or reniform, (8.9-)16.8(-28.7)x(4.0-)5.1(-5.9) µm; 159 phialides were measured.

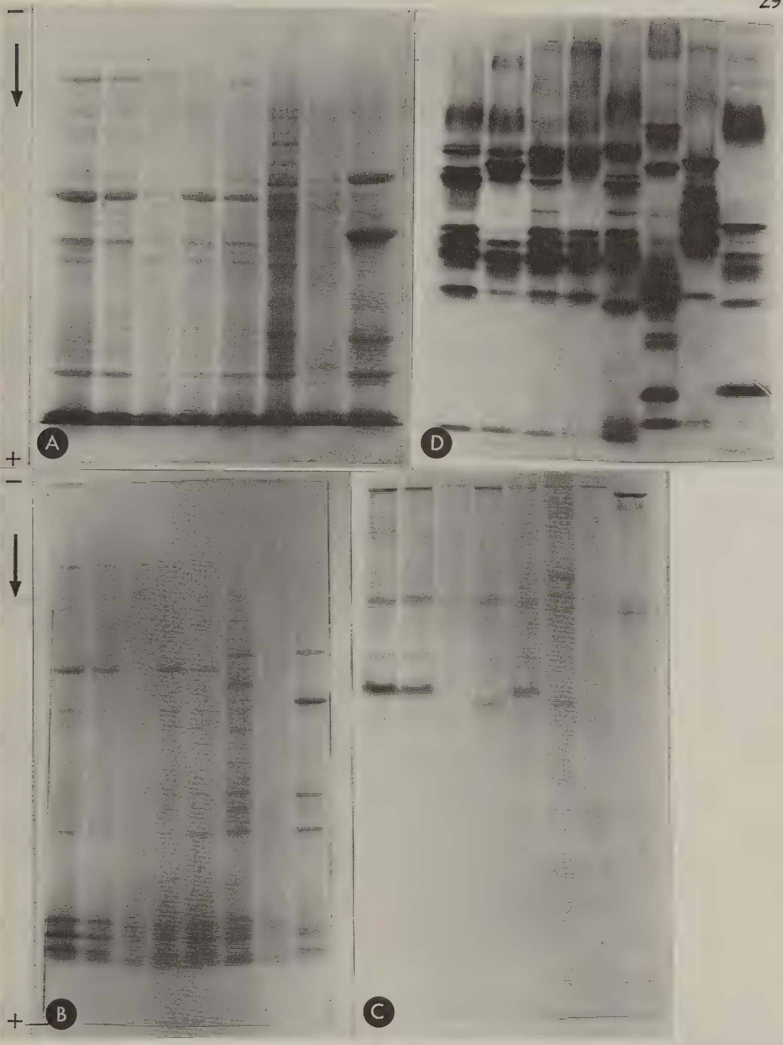

Fig. 3. Comparative protein and α-isoesterase banding patterns of *Cylindrocladium spathiphylli* isolated from heliconia and spathiphyllum with those of *C. floridanum*, *C. citri* and *C. crotalariae*. From left to right each lane represents banding patterns of HC-5, P86-107, P86-210 and P87-167 (from heliconia), ATCC 44730 (from spathiphyllum), *C. floridanum* (UFV-7A), *C. citri* (UFV-2A) and *C. crotalariae* (UFV-5A), respectively. A) Sodium dodecylsulfate (SDS) - proteins on 10% polyacrylamide gel electrophoresis (PAGE). B) SDS - proteins on 12-18% PAGE. C) Non SDS - proteins on 10% PAGE. D) α-isoesterases on 10% PAGE.

Macroscopic and microscopic characteristics of the perithecia were typical of *Calonectria* (8,9). This represents the first report of a sexual state of *Cylindrocladium spathiphylli*. This teleomorph (Fig. 1) is different from all known species of *Calonectria* with *Cylindrocladium* imperfect states (12), thus a new species, *Calonectria spathiphylli* is proposed.

Calonectria spathiphylli El-Gholl, J. Y. Uchida, Alfenas, T. S. Schubert, Alfieri, et Chase, sp. nov.

Perithecia gesta singulatim aut aliquando in turmis parvis, aurantiaca usque ad atroaurantiaca, pariete exteriore aspero et verrucoso. Perithecia a typis generis propriis sexualibus in segmentis foliorum *Howeiae forsterianae* super agarum aquosum et in segmentis foliorum *Dianthi caryophylli* super agarum aquosum inducta sunt. Perithecia (387-)529(-655) µm alta; (338-)493(-650) µm lata; asci (122-)172(-234)x(7.5-)15.4(-24.9) µm; ascosporae rectae usque ad falcatas, 1-usque ad 3-septatas, (16.8-)45.1 (-71.3)x(3.0-)4.9(-7.4) µm, (38.6-)52.9(-72.3)x(4.3-)5.2(-5.9) µm, et (40.6-)62.2(-71.3)x(4.8-)5.4(-6.7) µm, pro 1-3 septatis in ordine.

Holotypus: FLAS F55655, mense Aprili 1991.
Inductus in segmentis foliorum *Howeiae forsterianae* apud laboratorium DPI, Doyle Conner Bldg., Gainesville, FL, coniungendo *Cylindrocladium spathiphylli* P86-210 (seiunctum ab *Heliconia psittacorum*, collecta ab. L. I. Kavouras, Dover, FL, 1/20/86) et P87-167 (seiunctum ab *Heliconia* sp., collecta ab C. L. Lippincott, Miami, FL, 1/9/87).
Det. ab El-Gholl et al. mense Aprili 1991

Calonectria spathiphylli El-Gholl, J. Y. Uchida, Alfenas, T. S. Schubert, Alfieri, & Chase, sp. nov.

Perithecia borne singly or sometimes in small groups, orange to dark orange, with rough, warted outer wall. With appropriate mating types perithecia were induced on *Howeia forsteriana* leaf segments on water agar and on *Dianthus caryophyllus* leaf segments on water agar. Perithecia (387-)529(-655) µm high; (338-)493 (-650) µm wide; asci (122-)172(-234)x(7.5-)15.4(-24.9) µm; ascospores straight to falcate, 1- to 3-septate, (16.8-)45.1

TABLE 2. Combined conidial measurements (µm) of four *Cylindrocladium spathiphylli* cultures which were derived from single ascospores obtained from P87-167 (*Heliconia*) x P86-210 (*Heliconia*).

Conidia measured	1-septate conidia % of total	2-septate conidia % of total	3-septate conidia % of total
217	(38.8-)94.5(-147.6)x(4.5-)5.9(-7.1) 74.2%	(84.5-)113.1(-140.2)x(5.3-)6.3(-7.9) 23.5%	(89.5-)112.1(-141.7)x(5.9-)6.1(-6.3) 2.3%

(-71.3)x(3.0-)4.9(-7.4) µm, (38.6-)52.9(-72.3)x(4.3-)5.2(-5.9) µm, and (40.6-)62.2(-71.3)x(4.8-)5.4(-6.7) µm, for 1-, 2-, and 3-septate, respectively.

Holotype: FLAS F55655, April 1991.
Leaf seg. *Howeia forsteriana*: Induced in lab, DPI, Doyle Conner Bldg., Gainesville, FL, by mating *Cylindrocladium spathiphylli* isolate P86-210 (from *Heliconia psittacorum*, coll. by L. I. Kavouras, Dover, FL, 1/20/86) and P87-167 (from *Heliconia* sp., coll. by C. L. Lippincott, Miami, FL, 1/9/87).
Det. El-Gholl et al. April 1991

The two sexually compatible isolates P86-210 (mating type S-) and P87-167 (mating type S+) were deposited in the American Type Culture Collection, 12301 Parklawn Drive, Rockville, Maryland 20852, U.S.A. as ATCC 76545 and ATCC 76546, respectively.

ACKNOWLEDGMENTS

The authors thank Judy Mattes for typing the manuscript, Jeffrey W. Lotz and Amie Smith for the photography. Thanks are also extended to Dr. Lewis A. Sussman, Classics Department, University of Florida, for rendering the Latin description, to Dr. Gary W. Simone, Department of Plant Pathology, University of Florida, Gainesville, and to Dr. M. Aragaki, Department of Plant Pathology, University of Hawaii at Manoa, for reviewing the manuscript.

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Contribution No. 674, Bureau of Plant Pathology, Gainesville, FL

MYCOTAXON

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MYCENA GEESTERANI SP. NOV. IN PENINSULAR SPAIN

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Abstract.– *Mycena geesterani* is proposed as a new species. It belongs to section *Fuliginellae* and is characterized by its gelatinized pileipellis, stipitipellis and gill-edge, as well as by its very strongly amyloid and small spores.

Mycena geesterani Heykoop, Esteve-Raventós & Moreno sp. nov. (Figs. 1-11)

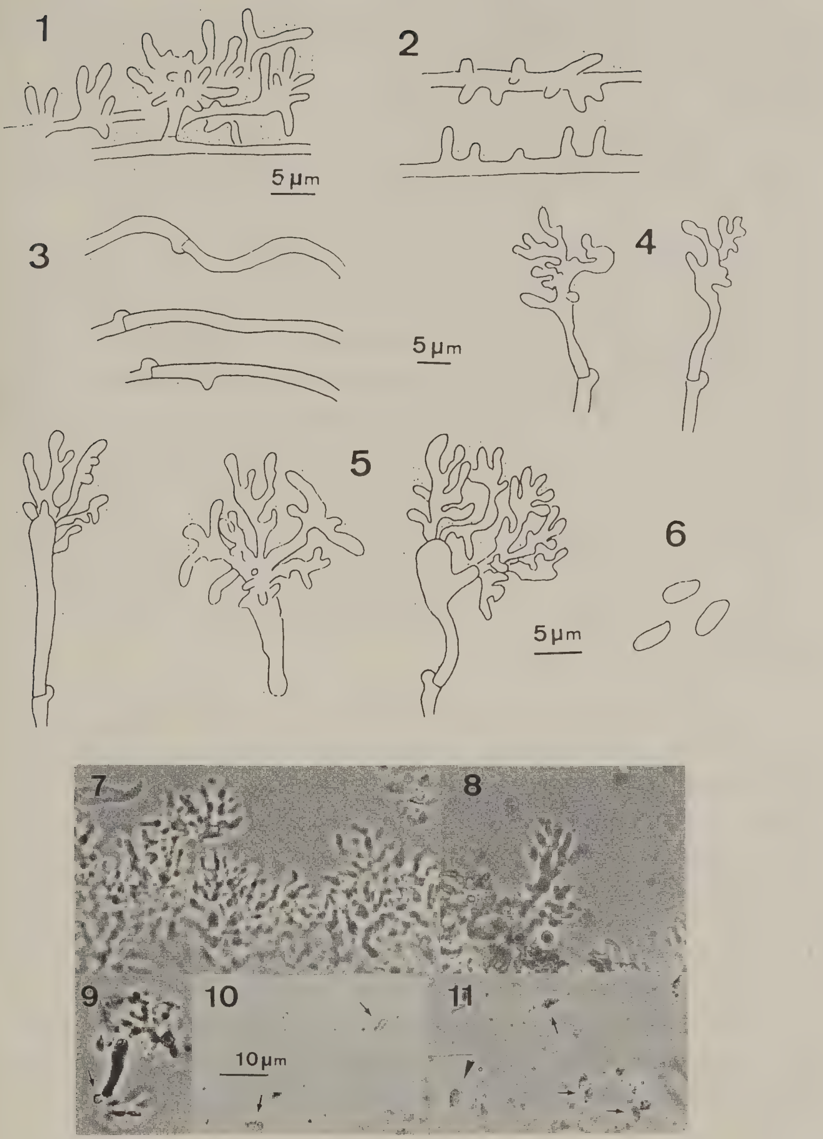
Etymology: in honour of Dr. Maas Geesteranus because of his great contribution to the knowledge of the genus *Mycena*.

Basidiomata gregaria, haud caespitosa. Pileus usque ad 1,2 cm latus, convexus, hygrophanus. Cutis cinerea, glabra, viscosa, specie glutinosa vestita. Lamellae trigonae, arcuato-decurrentes, albae, margines glutinosae. Lamellulae adsunt. Stipes 17 x 1 mm cremeo-cinereus, glutinosus. Pileipellis glutinosa, hyphis fibulatis constituta, 1-3 µm diam., crebris ramificationibus valde diverticulatis. Sporae 4-5 x 2-2,5 µm ellipsoideae, laeves, valde amyloideae. Basidia 14-22 x 3-4,5 µm, tetrasporica, clavata, fibulata. Margo lamellarum glutinosa. Cheilocystidiis 25-32 x 2,5-4,5 µm tenuiter claviformiis vel cylindricis, longas ramificationes diverticulatas in apice habentibus. Pleurocystidia absunt. Stipitipellis glutinosa. Hyphis fibulatis constituta 1,8-2,5 µm diam., laevibus aliqua diverticulata brevia habentibus. Caulocystidia 27-50 µm longa et 3-5 µm lata, cylindrica, copiosis et longis diverticulis ramificatis munita. Holotypus H.AH 13755, El Pinar, Sigüenza (Guadalajara), leg. F. Esteve-Raventós & J. Alvarez, 13-XI-88, in reliquiis lignosis et aciculis Pini pinastri et Pini sylvestris. Isotypus in herbario M. Bon.

Basidiomata gregarious, not cespitose. Pileus up to 1.2 cm in diam., convex, hygrophanous when moist, translucent-striate up to the centre, margin slightly involute when young, grey, sometimes with a reddish-brown colour at the centre, glabrous, viscid, covered with a gelatinous layer. Lamellae 13-27 reaching the stipe, triangular, arcuate-decurrent, white at maturity with ochre-yellowish tints and even reddish ones, with a gelatinous edge. Lamellulae present, 5-15. Stipe up to 17 x 1 mm, cream-grey, whitish pruinose at the apex, with gelatinized cuticle. Flesh white (in exsiccata). Smell and taste not recorded.

Spores 4-5 x 2-2.5 µm, pip-shaped, easily collapsed (thin wall), smooth, very strongly amyloid, taking an indigo-blue colour in Melzer's reagent. Basidia 14-22 x 3-4.5 µm, clavate, 4-spored, clamped, with sterigmata 3-4 µm in length. Gill-edge gelatinized (under the microscope it becomes detached as a band with different colour and consistence), cheilocystidia 25-32 x 2.5-4.5 µm, forming a sterile band (lamellar edge homogeneous), embedded in gelatinous matter, slightly clavate to cylindrical, clamped, with long diverticulate branches at the apex, with excrescences 1-1.5 µm wide. Pleurocystidia absent. Lamellar trama dextrinoid in Melzer's reagent. Pileipellis strongly gelatinized, forming an ixocutis consisting of clamped hyphae 1-3 µm wide, those near the upper surface slightly narrower (1-1.5 µm wide) and producing much branched and diverticulate side-branches. Stipitipellis gelatinized, forming an ixocutis consisting of clamped-hyphae 1.8-2.5 µm wide, smooth or with some short excrescences, terminal cells (caulocystidia) 27-50 µm long and 3-5 µm wide, cylindrical with numerous and long branched excrescences 1-1.8 µm wide.

Holotypus H.AH 13755, El Pinar, Sigüenza (Guadalajara), leg. F. Esteve-Raventós & J. Alvarez, 13-XI-88, among woody debris and needles of *Pinus pinaster* and *P. sylvestris*. *Isotypus* in the herbarium of M. Bon (Lille).


1
5 µm
2
3
5 µm
4
5
5 µm
6
7
8
9
10
10µm
11

Figs. 1–11.– *Mycena geesterani* H.AH 13755. 1-2: Hyphae of the pileipellis. 3: Hyphae of the stipitipellis. 4: Caulocystidia. 5 and 7-9: Cheilocystidia. 6 and 10-11: spores.

Because of its gelatinized pileipellis, stipitipellis and gill-edge, its arcuate-decurrent gills and the absence of yellowish tints on the stipe, *Mycena geesterani* is a typical member of section *Fuliginellae* (A.H. Smith ex Sing.) Maas G. (MAAS GEESTERANUS, 1989). Within this section there are only three species known to have arcuate lamellae, i.e. *Mycena austinii* (Peck) Kühn., *M. mackinawensis* A.H. Smith and *M. vulgaris* (Pers.: Fr.) Kummer (MAAS GEESTERANUS, l.c.). *M. geesterani* differs from the two first ones in having both of them pleurocystidia and much larger spores. *M. vulgaris* is very close (both without pleurocystidia), but differs in having spores which are less amyloid and also much larger, 6.7-8.3 x 3.6-4.9 µm versus 4-5 x 2-2.5 µm in *M. geesterani*. Because of the shape and small size of the spores our species resembles microscopically *M. tintinnabulum* (Fr.) Quél., the latter is, however, different in fruiting on stumps of broadleaved trees, and because of the absence of both a diverticulate pileipellis (KÜHNER, 1938; KÜHNER & ROMAGNESI, 1953) and a gelatinized gill-edge.

Mycena geesterani is very similar to *M. vulgaris* for which it can be mistaken macroscopically. When collecting this species we actually made this mistake, and this is the reason we did not pay enough attention and did not record with enough care all its macroscopic characters. Nevertheless, even with one single collection and without knowing its macroscopy with the desirable preciseness, its particular microscopic characteristics segregates it from all the known species of *Mycena*. This is the reason we describe this taxon as a new species and, besides, we point out the possibility it may have gone unnoticed or have been mistaken for records of *M. vulgaris*.

ACKNOWLEDGEMENTS

We wish to express our gratitude to Dr. Bon and Dr. Maas Geesteranus for revising and confirming our material as a new species. We are also gratefull to Dr. Maas Geesteranus for carefully going through the manuscript.

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TRICHOPHYTON KRAJDENII, SP. NOV.: AN ANTHROPOPHILIC DERMATOPHYTE

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ABSTRACT

Trichophyton krajdenii sp. nov., traditionally regarded as the nodular variant of *T. mentagrophytes*, is newly described as a dermatophyte of human skin and nails. Differences from *T. mentagrophytes* include the production of orange-yellow hyphae and diffusing reverse pigment and occasionally microconidia containing a resinous orange-yellow pigment, subsurface nodular hyphal bodies and slow, alkaline growth on bromocresol-purple casein dextrose agar. *T. krajdenii* did not produce fertile gymnothecia when mated with European and African tester strains of *Arthroderma vanbreuseghemii* and *A. benhamiae*.

INTRODUCTION

Morphological instability and variability among dermatophytes has been a perennial problem for medical mycologists concerned with dermatophyte taxonomy. The inability to reliably distinguish these fungi on the basis of morphological characteristics has resulted in large numbers of poorly defined species with unclear interrelationships.

With the recognition of more stable differentiating traits, a broader concept of species has been adopted which places less emphasis on gross colony morphology in the delimitation of species (Ajello and Georg, 1957; Kane and Fischer, 1971 & 1973). Instead colony morphology is used in infraspecific differentiation generating a more natural infrageneric classification scheme.

Differences in proteolytic activity on bromocresol-purple casein dextrose agar (BCPCDA) have long been used to distinguish dermatophyte species (Fischer and Kane, 1971; Kane and Smitka, 1980; Summerbell *et al.*, 1988). In some species, proteolytic activity is suppressed by the presence of dextrose in the medium. The pH responses and inhibitory function of dextrose in BCPCDA has made it possible to delineate the *T. rubrum* species complex consisting of *T. rubrum* (Castellani) Sabouraud and its variants, *T. raubitschekii* Kane *et al.*, *T. fischeri* Kane and *T. kanei* Summerbell (Kane, 1988). This medium has also proved useful in elucidating the *T. mentagrophytes* species complex which includes *T. krajdenii* and all of the colony and pigmentation variants of *T. mentagrophytes* (Robin) Blanchard (Fig. 1.). *T. mentagrophytes* is characterized by non-restricted growth with alkalinity on BCPCDA at seven days, the production of spherical or subspherical microconidia and spiral hyphae in the velvety, granular and red-pigmented variants (Kane and Smitka, 1980), the production of characteristic cigar-shaped, thin-walled, 3 - 5 septate macroconidia on Sabouraud's dextrose agar (SDA) (Malloch, 1981) amended with 3 - 5% sodium chloride (NaCl) (Kane and Fischer, 1973), the ability to perforate hair *in vitro* (Ajello and George, 1957) and positive hydrolysis of urea in Christensen's broth medium (Kane and Fischer, 1971).

Within *T. mentagrophytes* we categorize isolates into four groups based on colony texture and pigmentation: the cottony, velvety and red groups all of which are anthropophilic, and the granular group which is zoophilic. The cottony, velvety and red groups of *T. mentagrophytes* are known primarily as etiologic agents of tinea pedis, onychomycosis and tinea cruris while the granular group mainly causes tinea corporis, tinea capitis and tinea barbae (Rippon, 1988).

From both routine clinical isolations and from existing culture collections, we have examined isolates which share many of the previously mentioned attributes of *T. mentagrophytes* but differ in the production of both submerged nodular hyphal bodies and bright, diffusing, orange-yellow reverse pigment. The fungus, which we have named *Trichophyton krajdenii* sp. nov., is usually isolated from toenails and foot scrapings. Microscopic evidence of infection is typically demonstrated.

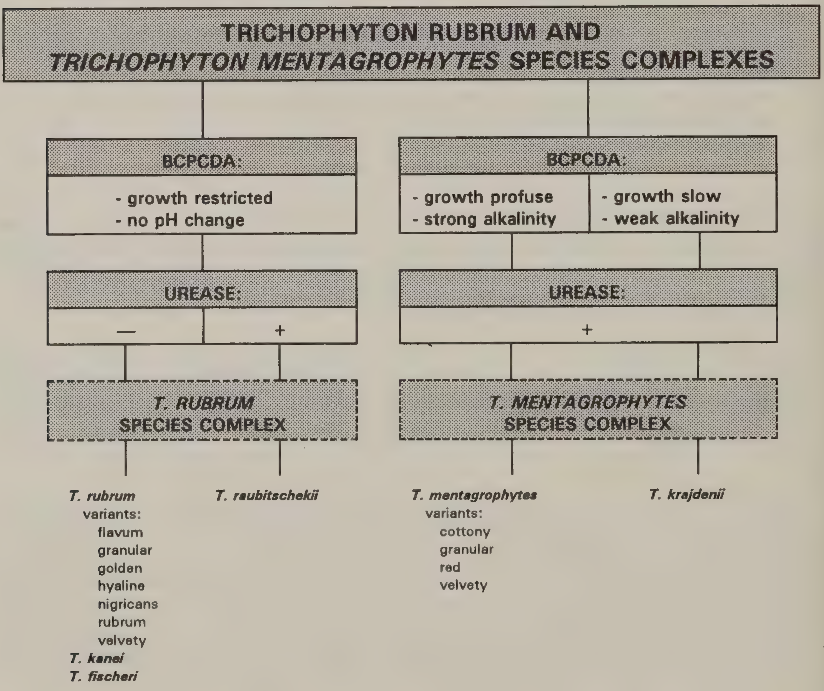

TRICHOPHYTON RUBRUM AND
TRICHOPHYTON MENTAGROPHYTES SPECIES COMPLEXES
BCPCDA:
- growth restricted
- no pH change
BCPCDA:
- growth profuse
- strong alkalinity
- growth slow
- weak alkalinity
UREASE:
—
+
UREASE:
+
T. RUBRUM SPECIES COMPLEX
T. MENTAGROPHYTES SPECIES COMPLEX
T. rubrum
variants:
flavum
granular
golden
hyaline
nigricans
rubrum
velvety
T. kanei
T. fischeri
T. raubitschekii
T. mentagrophytes
variants:
cottony
granular
red
velvety
T. krajdenii

Fig. 1: A graphic comparison of the *T. rubrum* and *T. mentagrophytes* species complexes.

MATERIALS AND METHODS

Test organisms:

Cultures of *T. krajdenii* and other related dermatophyte species used for comparison were obtained through routine clinical isolations from infected skin and nails, and from existing culture collections. Single conidium isolations were carried out to ensure the purity of each strain used on SDA amended with chloramphenicol (50 mg litre^{-1}), cycloheximide (500 mg litre^{-1}) and gentamicin (20 mg litre^{-1}).

Media used for comparison:

Mycelial fragments taken from a seven-day-old colony of each strain grown on SDA were used to inoculate test media including SDA, SDA amended with 3% NaCl, BCPCDA, Modified Leonian's agar (MLA) (Malloch, 1981), Czapek's yeast autolysate agar (CYA) (Pitt, 1979) and pyruvate agar (Saksun *et al.*, 1978). Cultures were incubated at 22°C and examined at seven and 14 days for the production of microconidia and macroconidia, reverse pigment formation, growth rate and physiological reactions. Colour descriptions cited in the present study correspond to the colour chart of Kornerup and Wanscher (1978). Individual isolates were tested for urease production using the technique described by Kane and Fischer (1971). Strains were also tested for growth at 37°C and the ability to perforate hair *in vitro* (Ajello and Georg, 1957).

Mating reactions:

Representative strains of *T. krajdenii* were crossed with European and African tester strains of *Arthroderma vanbreuseghemii* Takashio and *A. benhamiae* Ajello and Cheng, the teleomorphic states of *T. mentagrophytes*. Crosses were carried out on DSS medium (Takashio, 1972) at 22°C and observed at 21 days.

TAXONOMY

Trichophyton krajdenii Kane, J.A. Scott & Summerbell, sp. nov. Figs. 2-13

Coloniae in agaro 'Sabouraud' ad 54 mm diametrum in quattuordecim diebus ad 22°C crescentes, albidae, planae, appressae aut submersae, in centro dense velutinae, versus marginem regulares vel diffusiores, abrupte tenuiores, reverso in centro aurantiaco et margine luteocroceo vel flavido exhibentes; hyphae aeriae albidae, versus marginem coloniae spissae, subfarinosae vel subtomentosae aut floccosae; hyphae submersae aurantiacae, nodulis aurantiacis, incrassatis, incrustatis et interdum versus marginem coloniae filis appressis aut submersis, plumosis, effusis praeditae. Microconidia modice vel copiosa producta, unicellularia, hyalina aut raro pallide luteocrocea, clavata vel globosa, typice 2.5-3.5 x 2.0-2.5 μm magna, sessilia aut in brevibus conidiophoris apice singulatim genita. Macroconidia rare, hyalina, 3-4 (-5) septata, clavata, laevia, (20-) 25-30 (-40) μm magna.

Holotypus: in cute humana lectus est, in oppidum Edmonton, in Alberta provincia Canadensis regni, sine dato, L. Friedman, UAMH 3244.

Colonies on Sabouraud's dextrose agar attaining a diameter of 54 mm in 14 days at 22°C, white, flat, closely appressed or submerged, densely velvety at the centre, towards the margin regular to slightly diffuse, abruptly thinner, reverse orange (6A6 to 6B6) at the centre, orange-yellow (4A6) to yellow (3A6) near margin, with orange-yellow (4A7) pigment diffusing into medium, producing a sweetish odour suggestive of formalin, exudate lacking, unrestricted growth at 37°C; aerial hyphae white, subcompact near margin, subfarinose to subtomentose or minutely floccose, lacking on pyruvate agar; submerged hyphae on SDA usually orange-yellow (4A6), tending to form subsurface, swollen, nodular-like, encrusted, orange-yellow (4A8) hyphal aggregations, often associated with diffuse aggregations of orange-yellow pigment granules, occasionally in the form of condensed, resinous concretions encircling individual hyphae, closely appressed or submerged plumose, radiating strands sometimes forming towards margin. Microconidia moderately to weakly produced on SDA, abundant on BCPCDA and MLA, 1-celled, hyaline or occasionally orange-yellow, variable in shape, clavate to globose, usually 2.5-3.5 x 2.0-2.5 μm, sessile or borne apically on short, undifferentiated conidiophores. Macroconidia rarely produced on CYA, hyaline, 3-4 (-5) septate, clavate, smooth-walled, (20-) 25-30 (-40) x (3-) 4-5 (-7) μm, frequently with an empty, degenerated cell.

Weak urease activity was observed in Christensen's urea broth medium at seven days at 22°C. Slow, non-restricted growth on BCPCDA showed alkalinity at seven days at 22°C.

None of the extensive mating attempts produced fertile ascocarps within three weeks of incubation, suggesting complete incompatibility with the European and African tester strains of *A. vanbreuseghemii* and *A. benhamiae*; however, stimulation of a few sterile gymnothecia, as commonly occurs in crosses between different dermatophyte species, was seen in one instance. The isolate tested reacted as the "+" mating type. Thus far the teleomorphic state of *T. krajdenii* is unknown.

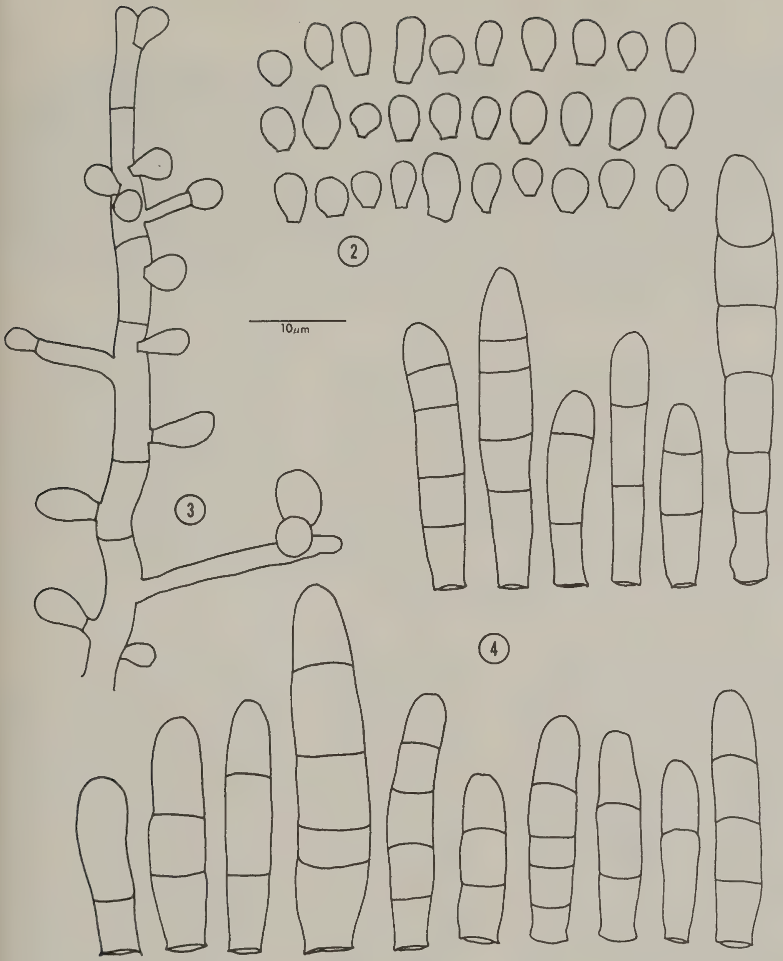
Habitat: *T. krajdenii* is known from human skin and nails, characteristically on the feet and toenails.

Etymology: Latinized from krajden, in honour of Dr. Sigmund Krajden, a dedicated Canadian physician who has made significant contributions in the field of infectious diseases.

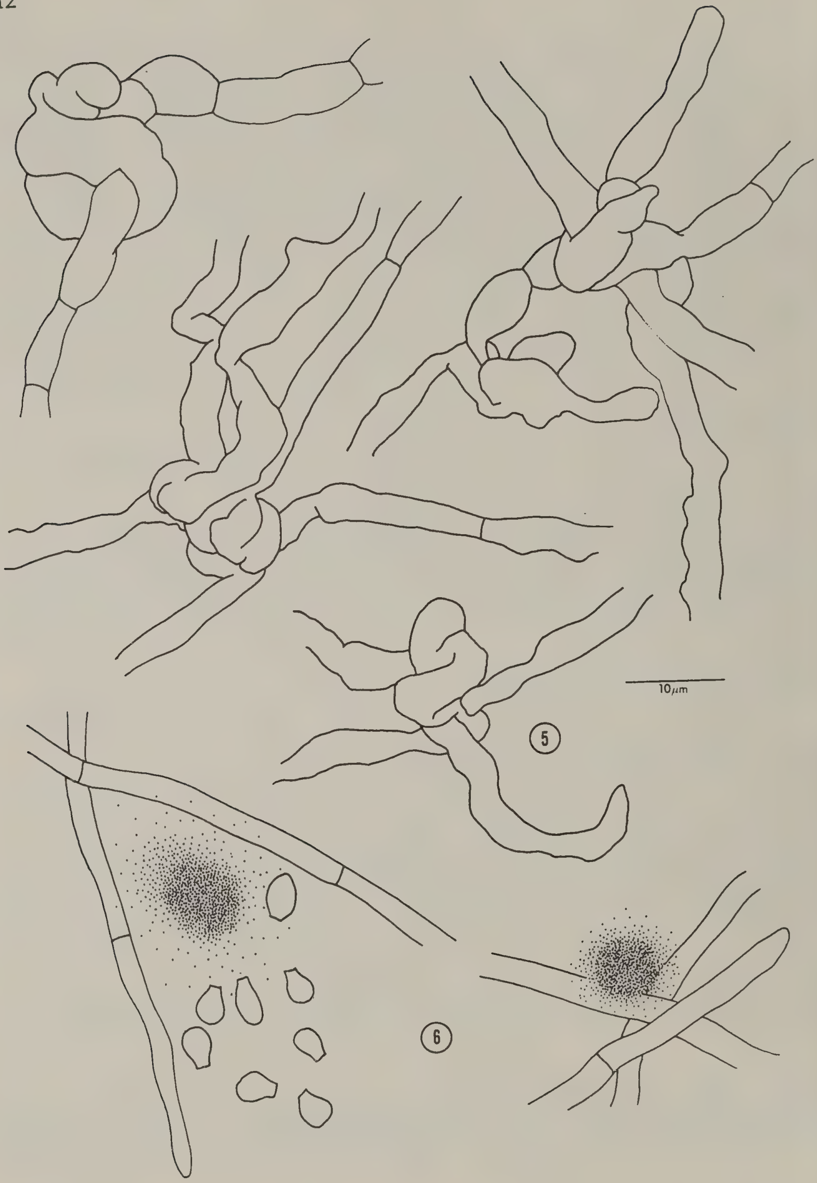
Specimens examined: CANADA: Alberta: Edmonton, nail scraping, left hand, 09 July 1969, *J.W. Carmichael*, UAMH 3253; Ontario: Toronto, Ontario Ministry of Health (OMH) OMH F13176, OMH F14300, OMH F13380, OMH F13350; Daniel Medical Laboratories (DML) DML 821067; USA: Georgia: Atlanta, skin lesion, no date given, *L. Friedman*, CDC X-441 (= TRTC 51348, UAMH 3244).

Specimens of other taxa examined: *T. mentagrophytes*, cottony strain (DML 487341), granular strain (DML 646544, OMH F13380, OMH F13350, OMH F13176), red strain (DML 566803) and velvety strain (DML 607678, OMH F13400).

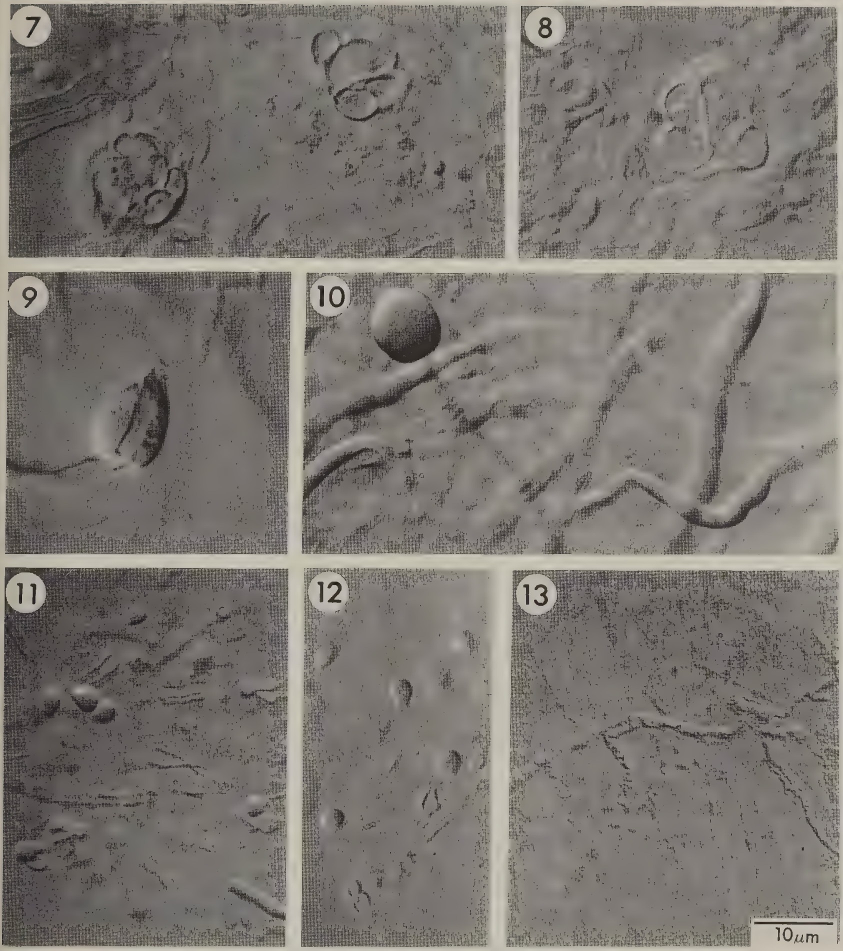
The major differential characters of *T. krajdenii*, *T. mentagrophytes* and *T. rubrum* are summarized in Table 1. *T. krajdenii* and *T. rubrum* share a common lack of macroconidial stimulation on SDA amended with 3% NaCl. Both *T. krajdenii* and *T. mentagrophytes* exhibit alkalinity on BCPCDA and urease activity, albeit to varying degrees.



Figs. 2-4: *Trichophyton krajdenii* sp. nov. (UAMH 3244), 2: microconidia on SDA; 3: habit of microconidial production on SDA; 4: macroconidia on CYA.



Figs. 5-6: *Trichophyton krajdenii* sp. nov. (UAMH 3244), 5: subsurface nodules on SDA; 6: aggregations of pigment granules on SDA.



Figs. 7-13: *Trichophyton krajdenii* sp. nov., 7-8: subsurface nodules on SDA; 9-10: resinous concretions on SDA; 11-12: microconidia on SDA; 13: atypical hyphae in scrapings from tinea pedis mounted in 10% sodium hydroxide.

Table 1. A comparison of characters of *T. krajdenii*, *T. mentagrophytes* and *T. rubrum*

	Organism		
Character	*T. krajdenii*	*T. mentagrophytes*	*T. rubrum*
Macroconidia on SDA + 3% NaCl	absent	present	absent
In vitro hair perforation	present	present	absent
Urease activity	present (weak)	present	absent
Growth on BCPCDA	slow, alkaline	rapid, alkaline	restricted, non-alkaline
Pyruvate medium	aerial growth absent, colonies orange-yellow	white aerial mycelium	white aerial mycelium
Reverse pigment on SDA	orange-yellow	may be light-yellow or wine red	blood red in *T. rubrum* var. *rubrum*
Special features	subsurface hyphal nodules, orange-yellow hyphae	four colony-texture and pigmentation variants	seven colony-texture and pigmentation variants

DISCUSSION

Although the existence of the dermatophyte named in this paper has long been acknowledged, its taxonomic circumscription has been unsettled. Biltris (1929), Emmons (1932) and English (1970) all reported observing a red-pigmented nodule-producing mutant which arose from cultures of the 'gypseum' group of trichophytons (*sensu* Sabouraud, 1910). English suggested that this mutant was associated with a normal *T. interdigitale* Priestley strain. Emmons (1934) noted the resemblance of these 'nodular' organs to developing ascogonial coils, suggesting an ancestral link to the ascomycetes. Later Georg and Maechling (1949) discussed, although never formally described *Trichophyton mentagrophytes* 'nodular' since a Latin diagnosis was neither provided nor referenced upon its publication in accordance with Article 36 of the International Code of Botanical Nomenclature (Greuter *et al.*, 1988). They opted for varietal in favour of specific designation to avoid the generation of a superfluous specific epithet noting that cultures derived from single conidium isolates were highly mutable and could produce many variations within a single colony. The features exemplified by the 'nodular variant' (orange reverse pigment and nodular bodies), they pointed out, were often encountered in the 'gypseum' group of dermatophytes (Sabouraud, 1910; Biltris, 1929; Catanei, 1929; Emmons and Hollaender, 1939). For these reasons it was felt that many of the so-called 'species' in the 'gypseum' group did not merit specific designation, but rather should be regarded as variants of the 'type' species of the group, *T. mentagrophytes*. Benham (1953) acknowledged the variability within the 'gypseum' group, that she felt contained a number of 'types' representative of distinct species, but which should be retained as varieties of *T. mentagrophytes* until more stable differential characters were found. Silva and Benham (1954) later included what they deemed '*T. nodulare* Georg and Maechling' (1949) in the informal 'gypseum' group.

The clinical isolates and herbarium specimens of *T. krajdenii* which we have examined show it to be a distinctive species with consistent morphological and physiological differences from existing taxa. *T. krajdenii* can easily be distinguished from members of the *T. rubrum* species complex by its slow, non-restricted alkaline growth on BCPCDA. Like *T. krajdenii*, *T. mentagrophytes* is also noted for producing an initial alkaline reaction on BCPCDA, however growth of the latter is always profuse, exhibiting a strong alkaline reaction at seven days. Typically, *T. krajdenii* initially yields a relatively weak alkaline reaction which becomes stronger after ten days (Summerbell *et al.*, 1988).

Despite some physiological similarities on BCPCDA, *T. krajdenii* is readily distinguishable from *T. mentagrophytes sensu lato* by the abundant production of subsurface hyphal nodules, orange-yellow hyphae and brilliant orange-yellow colony-reverse pigment.

The correct identification of potentially pathogenic organisms is crucial to the determination of effective courses of treatment. Unfortunately, reliable clinical identification of dermatophytic fungi is often complicated by both a lack of expertise in fungal identification and an unavailability of adequate taxonomic information.

T. krajdenii has been a subject of much diagnostic confusion. An independent proficiency survey of nine medical laboratories that analyze mycology specimens by one of us (J.K.) revealed that none were able to provide a reliable identification of this pathogen, and several concluded that it was a non-pathogenic entity. It is our hope that the recognition of this clinically important yet previously undescribed dermatophyte species will eliminate the confusion it has produced.

ACKNOWLEDGEMENTS

We would like to express our appreciation to Daniel Medical Laboratories for providing a research grant, and to Dr. D.W. Malloch for providing additional financial support. Dr. I. Weitzman is thanked for independently repeating mating tests with several isolates of *T. krajdenii*. Dr. L.M. Kohn and Dr. G.R. Sibbald kindly acted as reviewers for this manuscript. We are grateful for the help of Dr. J. Krug with the Latin diagnosis and for his sound advice. Maria Witkowska and Mary Porretta are thanked for technical assistance.

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A NEW KERATINOPHILIC *GYMNOASCUS* FROM BOLIVIAN SOIL

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SUMMARY

A new species of *Gymnoascus* is described. This species, *G. boliviensis*, is characterized by having lenticular ascospores organized in a petaloid pattern within the ascus. The anamorph belongs to *Malbranchea*.

As has been demonstrated by many investigators, soil is an important reservoir of keratinophilic fungi (GARG *et al.*, 1985); many species being ubiquitous, while others are geographically restricted. Using the spray technique (KUEHN, ORR & GHOSH, 1961) and hair baiting (VANBREUSEGHEM, 1952), we have investigated these fungi from South American soils, and have isolated a fungus of interest whose main characteristics do not agree well with known species. We describe it herein as a new species of *Gymnoascus*.

Gymnoascus boliviensis Guarro, Ulfig *et* de Vroey *sp. nov.*
Anamorph: *Malbranchea sp.*

Etym.: boliviensis - referring to the country where the species was isolated from (Bolivia).

(Fig. 1,2)

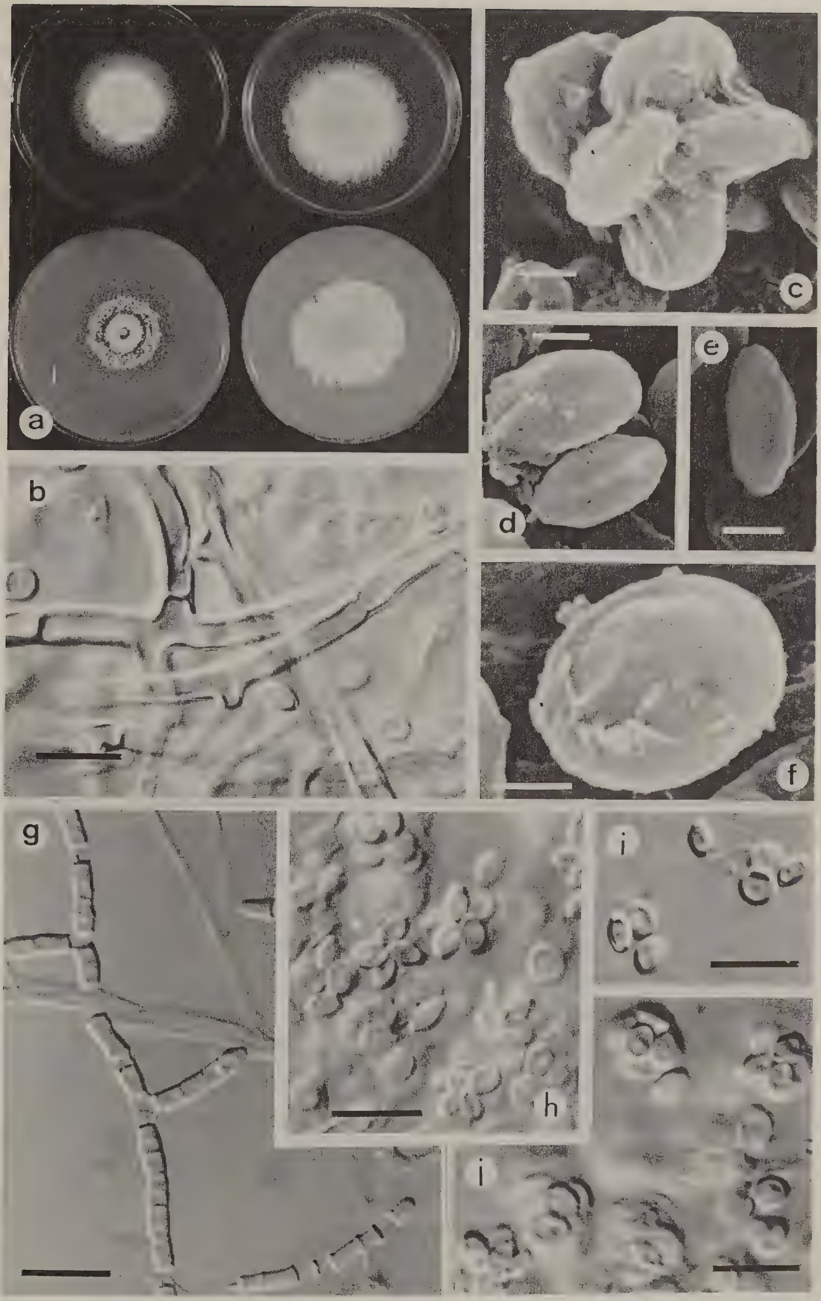
Fungus homothallicus. Ascocarpi discreti absentes. Catervae ascorum plus *minusque* 1000 *μm diametri, pallidi-aurantiaceae. Hyphae peridiales dissimiles ab hyphis vegetativis, leves, septatae, ramosae, anastomosantes, flavae, crassi-tunicatae,* 1.5-3.5(5.0) *μm diametri; ascis numerosis, evanescentis, octosporatis, flavis, irregulare globosis vel subglobosis,* 6.0-8.0 *μm diametri. Ascosporae in dispositione petaloidea in asco, unicellulares, lenticulares, flavae, cum distincto margine,* 3.0-4.0 x 1.8-2.2 *μm. Hyphae vegetativae hyalinae, sparse ramosae, septatae,* 1.5-3.0 *μm crassae. Arthroconidia numerosa, cylindrica vel doliforma, hyalina, non-septata, tenui-tunicata, laevia,* 2.0-7.0 x 2.0-2.5 *μm. Arthroconidia ex hyphis principalibus crassiorstet, aliquando inflata,* 2.0-5.0 x 2.5-3.5 *μm. Fungus moderate keratinolyticus.*

Holotypus: *ex solo, in collectione fungorum IMI, Kew, Britannia deposita est.* **Isotypus:** *FMR 3793.*

Fungus homothallic. On water agar (WA) and on sterilized soil supplemented with hair, at 25 °C, clusters of asci appearing in 14 days and forming dense, orange-white (6A2; KORNERUP & WANSCHER, 1984) aggregations of ± 1000 μm diam, coalescing. Peridial hyphae interwoven, differentiated, septate, branched, mostly anastomosed at right angles, slightly constricted at the septa, yellow, relatively thick- and smooth-walled, 1.5-3.5(5.0) μm diam. Appendages lacking. Asci numerous, evanescent, 8-spored, yellow, globose to subglobose, 6.0-8.0 μm diam. Ascospores 1-celled, yellow, lenticular, organized within an ascus in a petaloid pattern, with a distinct equatorial thickening, 3.0-4.0 x 1.8-2.2 μm. Vegetative hyphae sparsely branched, hyaline, septate and 1.5-3.0 μm broad. Primary arthroconidia formed by segmentation of the broader primary conidiogenous hyphae, 2.0-5.0 x 2.5-3.5 μm, frequently broader than long. Secondary arthroconidia borne on narrower, straight or sometimes slightly curved lateral branches, 2.0-7.0 x 2.0-2.5 μm. Both types of arthroconidia numerous, hyaline, 1-celled, cylindrical or barrel-shaped, smooth- and thin-walled. Racquet hyphae and chlamydospores not observed.

On phytone yeast extract agar (PYE) at 25 °C, colony growth rate moderately rapid, with a mean daily spread of 3.7-4.6 mm, flat, with a central umbo, cottony, at first yellowish-white (2A2), soon becoming orange white (5A2); margin ill-defined, fimbriate; reverse light orange (6A5) to orange-red (8A6).

Fig. 1. *Gymnoascus boliviensis* (FMR 3793). a. 21-day cultures on PYE, PDA, OA and YpSs; b. peridial hyphae (Nomarsky) (bar = 10 μm); c. ascus (SEM) (bar = 1 μm); d-f. ascospores (SEM) (bar = 1 μm); g. anamorph (N) (bar = 10 μm); h-j. asci and ascospores (N) (bar = 10 μm).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On potato dextrose agar (PDA), colony with a mean daily spread of 5.0-5.2 mm, also flat, with a central umbo, cottony, denser than on PYE, concentrically arranged, initially yellowish-white (3A2), later becoming pale orange (6A3) to orange (6A6); exudation droplets golden; margin ill-defined, finely fimbriate, irregular; reverse light orange (5A4).

On oatmeal agar (OA), colony flat, with sparse aerial mycelium, concentrically arranged, at first white, soon becoming greyish-orange (6B4); lacking a distinct odour; margin undefined; reverse pastel red (7A5).

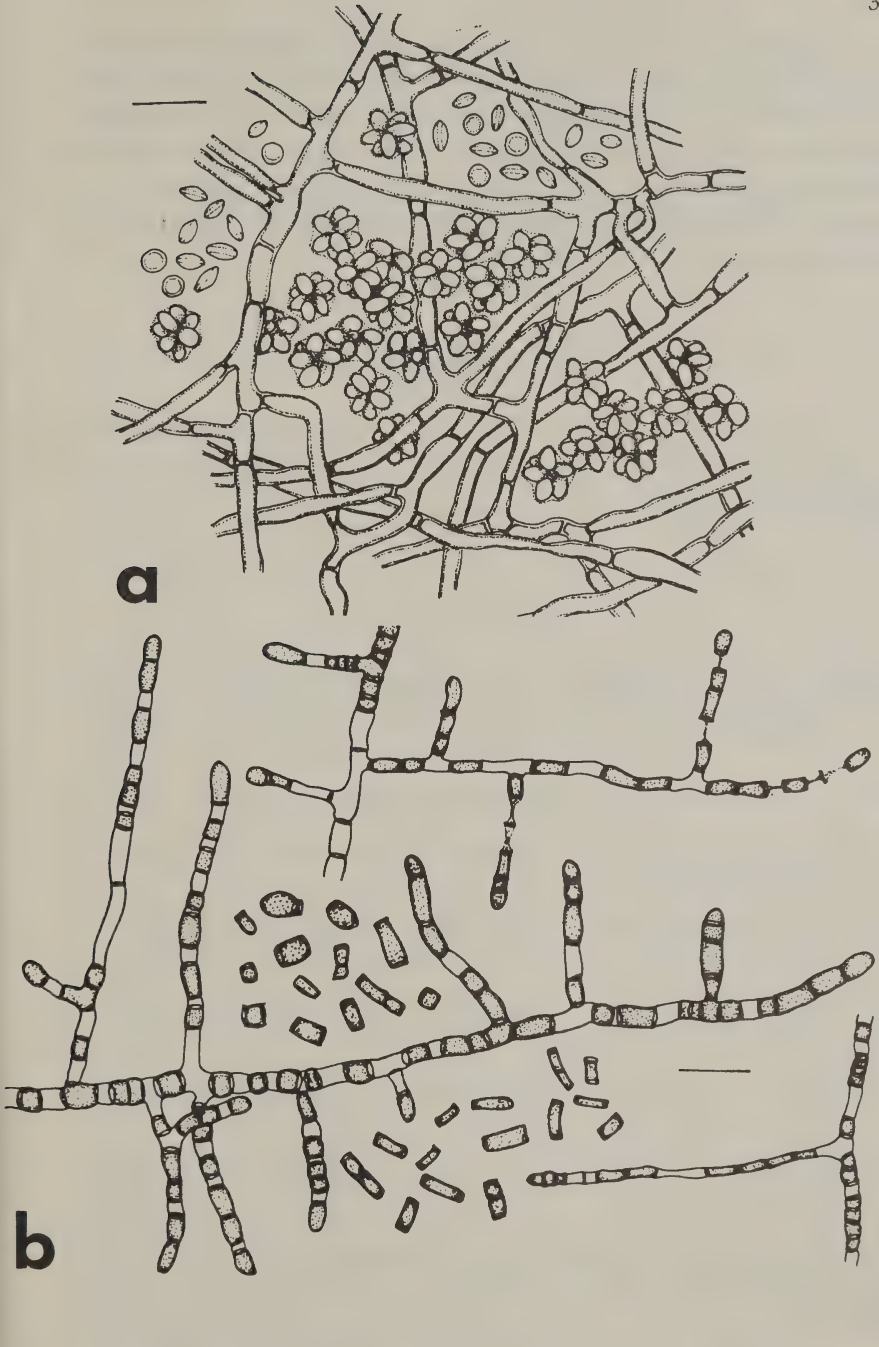
On YpSs, colony dense, flat, with a wide central umbo, pale orange (5A3); exudation golden; margin undefined; reverse uncoloured.

The colony displays limited growth at 37 °C, attaining, on PDA, 5-6 mm diameter in 21 days. It is only slightly keratinolytic, producing penetrating hyphae on horse hair, as observed according to the technique of AJELLO & GEORG (1957).

Material examined: FMR 3793 (RV 29367), from soil sample (chicken yard) collected in Trinidad, Bolivia, 11 Oct. 1972; isolated by De Vroey & Villavicencio with the Vanbreuseghem's hair-baiting method in Antwerp.

The genus *Gymnoascus* Baranetzky was revised by VON ARX (1986) who delimited 14 species mostly isolated from soil, dung and plant residues. Recently, the fifteenth species was isolated from Spanish soil and described by CANO & GUARRO (1989). *G. boliviensis* should be classified among the species with a distinct peridium and small ascospores (3.0-4.0 μm diam). This group embraces: *G. alatosporus* Natarajan (NATARAJAN, 1971); *G. reessii* Baranetzky and *G. petalosporus* (Orr, Roy *et* Ghosh) v. Arx (ORR *et al.*, 1977). *G. boliviensis* strongly resembles *G. petalosporus* in having ascospores organized in a characteristic petaloid pattern and slender peridial hyphae. *G. petalosporus* may be distinguished from *G. boliviensis* by producing ascospores without a distinct equatorial thickening and also by its darker (brown) colonies and ascomata. The ascospores of *G. boliviensis* are quite similar to those of *G. alatosporus*. The latter, however, produces distinctly brown ascomata with straight, unbranched appendages and very thin (0.5-1.0 μm) peridial hyphae. *G. reessii* has ascomata with stiff peridial hyphae and spine-like, branched, recurved appendages and lenticular ascospores without an equatorial thickening.

Fig. 2. *Gymnoascus boliviensis* (FMR 3793). a. peridial hyphae, asci and ascospores (bar = 10 μm); b. anamorph (bar = 10 μm).


a
b

The anamorph of *G. boliviensis* is typical for the subgroup of *Malbranchea* characterized by straight, branched and narrow (1.5-3.0 μm), fertile hyphae. Arthroconidia of *G. boliviensis* closely resemble those observed in *M. flava* Sigler & Carmichael and *M. fulva* Sigler & Carmichael. If based only on the morphology of the conidiogenous hyphae and conidia, a clear delimitation of these anamorphs is not possible. However, the colony features and the presence of the teleomorph in *G. boliviensis* enables the distinction to be made.

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PHOMATOSPORA BERKELEYI , P. ARENARIA AND THEIR SPOROTHRIX ANAMORPHS

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Cultures of *P. arenaria* were derived from crushed sections of mature perithecia. Cultures of *P. berkeleyi* were derived from ascospores. *Sporothrix* anamorphs formed in cultures of both species of *Phomatopora*. Conidia are ellipsoidal to falcate and are produced holoblastically from discrete or integrated, denticulate, sympodially proliferating conidiogenous cells. Classification of *Phomatospora* is discussed.

Most species of *Phomatospora* Sacc. have not been linked to anamorphs (see reviews in Arx, 1981a; Barr, 1990). Webster (1955), however, found a *Dinemasporium* Lév. anamorph for *P. gramineum* Webster. Recently I have isolated *P. arenaria* Sacc., Bommer & Rousseau and *P. berkeleyi* Sacc., the type of *Phomatospora*, into pure culture and observed *Sporothrix* anamorphs for both.

MATERIALS AND METHODS

Ascomata of *Phomatospora arenaria* [GREAT BRITAIN. Cornwall: Constantine Bay, on *Ammophila arenaria* (L) Link., Jul 1990, F. Rappaz (LAU)] were sectioned with a razor blade. Their contents were examined in a drop of sterile water on a sterile microscope slide and sections were crushed and transferred to a Petri dish containing Malt Agar with Asparagin (MAA : malt extract Difco : 20 g, asparagin : 0.5 g, KH_2PO_4: 0.5 g, $MgSO_4.7H_2O$: 0.2 g, agar : 15 g, H_2O : 1 l). Growing colonies were then transferred to MAA, CMA (Maize meal : 30 g, malt extract Difco : 20 g, H_2O : 1 l) and PDA. (pealed and cut potatoes : 200 g, malt extract Difco : 20 g, glucose 20 g, H_2O : 1 l) and incubated at 20 - 25 °C under diffuse daylight.

Cultures of *P. berkeleyi* [FRANCE. Finisterre : Roscoff, on *Ammophila arenaria* , Oct 1991, J. Clot (LAU)] were obtained by fixing a fragment of a culm of *A. arenaria* with perithecia to double-sided tape. The tape with culm was soaked one hour in water. It was then affixed on the lower side of the cover of a Petri dish containing water agar covered with a sterile cellophane (Cellophane "celloclair" for domestic use). Deposit and germination of the ascospores was observed under the 40x objective. Fragments of cellophane, each with many ascopores germinating, were transferred to MAA and incubated as above.

Observations of the anamorphs were made by squashing a small amount of mycelium directly in water or in cotton blue, or by affixing hyphae to transparent tape and then mounting in cotton blue. Dimensions in the description are based on 50 measurements. They are rounded to unity and are given as the confidence limit at a 95 % level in brackets, and as the mean plus/minus the standard deviation.

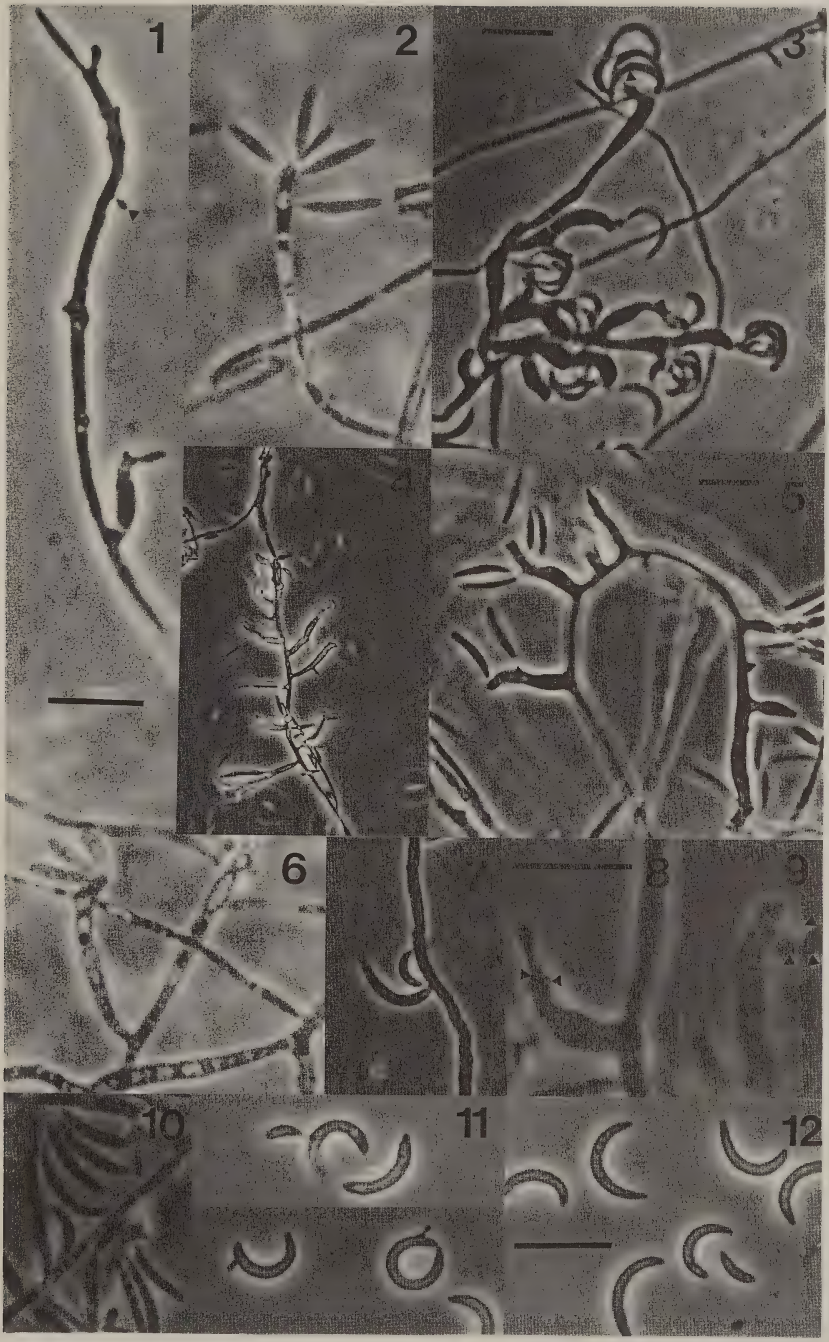
RESULTS

Phomatospora arenaria Sacc., E. Bommer & M. Rousseau, in Bommer & Rousseau, Bull. Soc. r. Bot. Belg. 29 : 276, 1890.
Fig. 1, 2, 4 - 6, 10, 13.

Colonies reaching 40 mm in diameter after three weeks, on all three media. Aerial mycelium abundant and cottony on MAA much less on PDA and CMA. On MAA, hyaline fascicules 1-3 mm long were formed around the inoculum after three weeks. Conidia forming after one month on MAA, after two months on PDA; none forming on CMA. Conidiophores on MAA and on PDA inconspicuous and arising as short (10 - 30 µm) lateral branches of hyphae, each terminating in a single conidiogenous cell (6) 10 - 15 (21) x 2 - 3 µm, or conidiophores not distinct from vegetative hyphae and conidiogenous cells forming from intercalary hyphal cells (fig. 13). Conidiogenous loci denticulate, forming over the upper half to third of each conidiogenous cell, 1 - 10 µm long, more or less distorted depending on its width, or lateral by restored hyphal growth. Denticles 0.3 - 0.8 µm long, 0.3 - 0.5 µm wide, each producing a single holoblastic conidium before proliferating sympodially to form the next and succeeding conidium. Conidia falcate, subcylindrical, rarely ellipsoidal, (4) 6 - 9 (11) x 1 - 2 µm, hyaline, one-celled, smooth; apex narrowed, base truncate, 0.5 µm wide, up to 1 µm wide in ellipsoidal conidia. Conidia germinating promptly by a germ tube or by forming secondary conidia directly on a denticle.

Perithecial primodia formed after one month on CMA, after three months on MAA; none formed on PDA; primordia remaining sterile.

Fig. 1 - 12 *Sporothrix* anamorph of *P. arenaria* (1, 2, 4, 5, 6, 10) and of *P. berkeleyi* (3, 7, 8, 9, 11, 12). Scale: standard lines are 10 µm. Same scales in fig. 1, 2, 6; in fig. 4, 5; in fig.7, 8, 9; in fig. 11, 12. Fig. 1 hypha bearing a conidium (arrow) and a conidiogenous cell. Fig. 2 apical conidiogenous cell with conidia. Fig. 3 cluster of conidigenous cells. Denticles (arrow) on the conidiogenous locus of the higher cell can be seen. Fig. 4 and 5 conidiogenous cells on a vegetative hypha. Note the apical growth of the conidiogenous cells on the left of fig. 5. Fig. 6 subulate conidiogenous cell. Fig. 7. conidium borne on a vegetative hypha. Fig. 8 young conidium initial at the apex of a conidiognous cell and denticulate conidial secession scars (arrows). Fig. 9 forked conidiogenous locus and denticles (arrows). Fig. 10 and 12 conidia. Fig. 11 conidia giving rise to a secondary conidium.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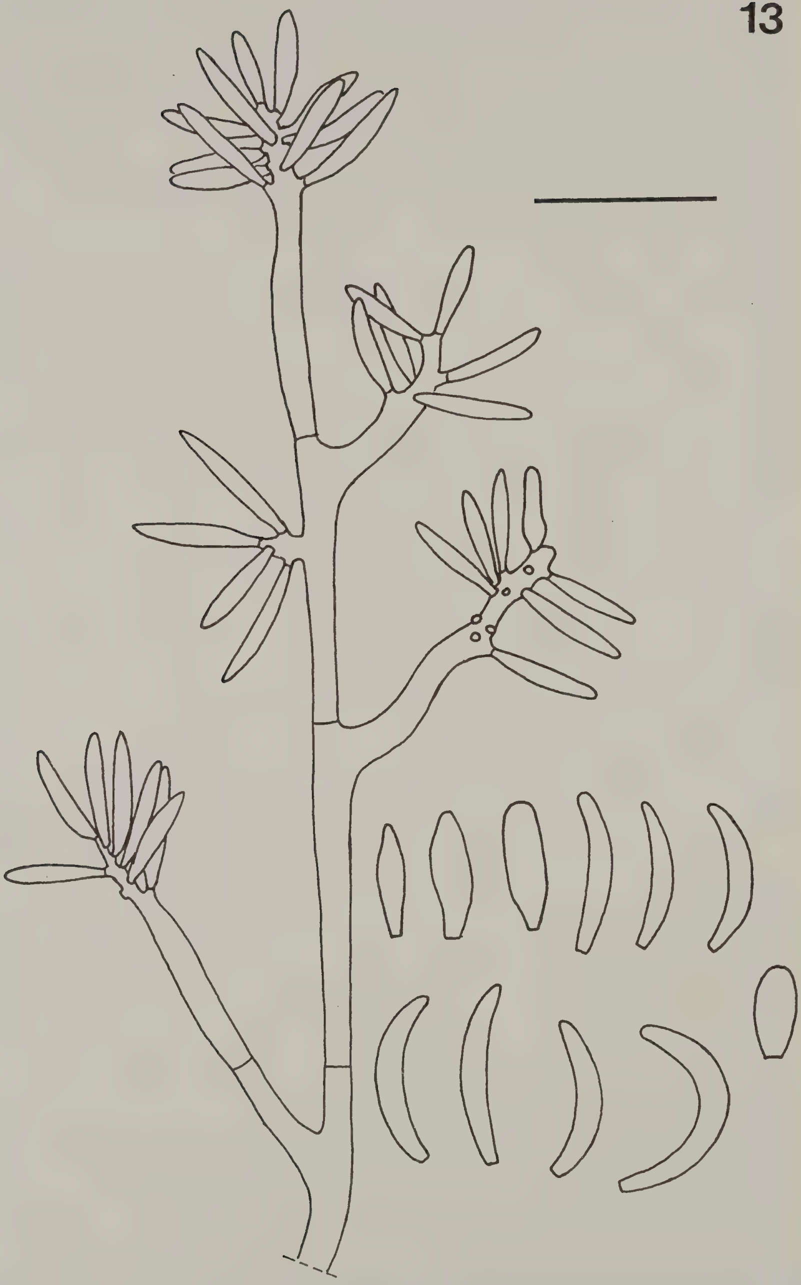

Fig. 13 *Sporothrix* state of *Phomatospora arenaria*. Conidiogenous cells with conidia. Line = 10 µm.

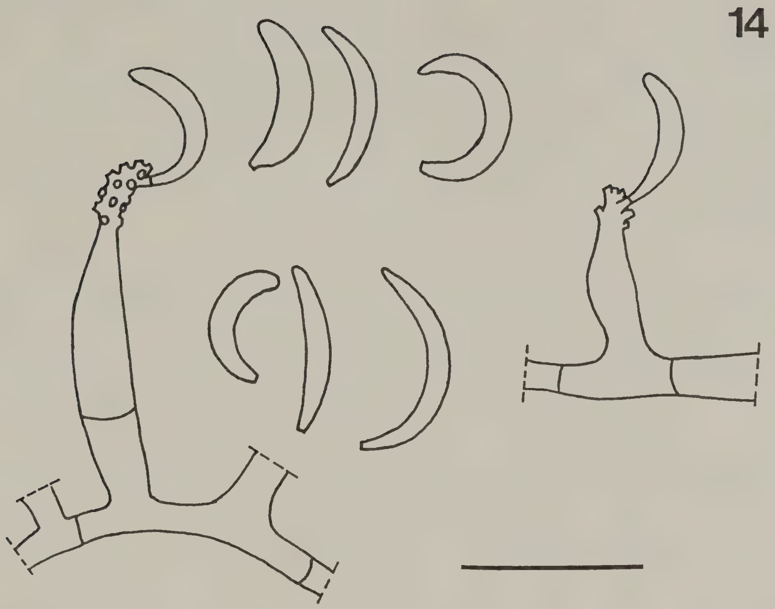

Fig 14 *Sporothrix* state of *Phomatospora berkeleyi.* Conidiogenous cells with conidia. Line = 10 µm.

Phomatopora berkeleyi Sacc., Nuovo Giorn. Bot. It. 7 : 306, 1875.
Fig. 3, 7 - 9, 11, 12, 14.
Ascospores germinating within 24 h, producing a network of hyphae on cellophane from which conidiogenous cells arise after 8 days. Colonies reaching 15 mm in diameter after three weeks on MAA. Aerial mycelium abundant and cottony. After three weeks, hyaline fascicles 1 - 3 mm long were formed in the center of the colonies. Conidiophores, conidiogenous cells and conidiogensis as in *P. arenaria*. Conidiogenous cells (7) 9 - 13 (15) x 2 - 3 µm. Conidia found after three weeks on MAA, falcate, more curved then in *P. arenaria*, sometime torsive (not in one plane) or sigmoid, rarely ellipsoidal, (7) 9 - 13 (18) x 1 - 2 µm, one-celled, hyaline, smooth; apex narrowed, base truncate. Conidial germination as in *P. arenaria.* Mature ascomata forming within 25 days on MAA.

DISCUSSION

Both of these species of *Phomatospora* have been redescribed by Eriksson (1967). The fine striations on the ascospores were not mentioned by him, but Kirk (1984) and Barr (1990) did observe this feature.

The anamorphs of *P. arenaria* and of *P. berkeleyi* are similar, except for growth rate and conidial size.*P. arenaria* is host specific but *P. berkeleyi* grows on wood as well as herbaceous stems. Whether this ability to decompose various substrates reflects in cultural characters remains unknown.

Falcate conidia are produced on denticulate sympodially proliferating conidiogenous cells by species of *Idriella* Nelson and Wilhelm, *Microdochium* Sydow and *Selenosporella* Arnaud ex Mac Garvie. The anamorphs of *P arenaria* and *P. berkeleyi* cannot be referred to *Selenosporella* because conidiophores and conidioge-nous cells of species of that genus are melanized and the conidia form exclusively at the tip of the conidiogenous cell. Samuels and Rossman (1987) and Samuels et al. (1987) found *Selenosporella* anamorphs for two species of *Oxydothis*, and *Iodosphaeria phyllophila* (Mouton) Samuels, Müller & Petrini, respectively.

The anamorphs of *P arenaria* and *P. berkeleyi* are very similar to *Microdochium caespitosum* Sutton, Pirozynski & Deighton and *M. griseum* Sutton, Pirozynski & Deighton (see Sutton et al.,1972) but these species are generically distinct from *M. phragmitis* H. Sydow, the type species of *Microdochium*. Arx (1981b) redisposed them in *Idriella* because of the production of dark swollen hyphal cells. Most of the *Idriella* species when studied in culture formed chlamydospores which have not been seen here. *Idriella* anamorphs has been linked to the inoperculate discomycete *Hymenoscyphus caudatus* (Karst.) Dennis (Kimbrough & Atkinson, 1972) and to *Dothiopeltis* Müller in the Rhytismatales (Crivelli and Müller, 1983). Samuels and Hallett (1983) redescribed *Microdochium* as having broad, sympodially proliferating conidiogenous loci and linked the genus *Microdochium* to the ascomycete genus *Monographella* Höhnel, which Barr (1990) included in the Hyponectriaceae. *Microdochium phragmitis* differs from the anamorphs of *P arenaria* and *P. berkeleyi* by its conidiogenous loci with denticles that are ill defined (as illustrated in Sutton et al., 1972; Samuels & Hallett, 1983).

The genus *Sporothrix* Hektoen & Perkins is characterized by the formation of hyaline, denticulate conidiogenous cells that form on undifferentiated hyphae or from intercalary hyphal cells. Conidia of *S. curviconia* de Hoog are curved, and elongate conidia are common in other species (de Hoog, 1974). While species of *Sporothrix* are morphologically simple, and that genus may be polyphyletic because of that, the anamorphs of *P. arenaria* and *P. berkeleyi* can be assigned to it. Known teleomorphs of *Sporothrix* are species of *Ophiostoma* H. & P. Sydow, a genus of the Ophiostomataceae (Microascales; Barr, 1990) and not obviously related to *Phomatospora*.

Perithecia of species of *Phomatospora* are nonstromatic and are immersed in host tissue. They are black, soft-textured, and possess an apical ostiolum with periphyses. The surface of the perithecial wall is puzzle-like, *textura epidermoidea*. Asci form in a basal layer and are interspersed with apically free paraphyses at an early stage of development. The asci are unitunicate and have a shallow, inamyloid ring in the apex. This suite of characters indicates that *Phomatospora* could be classified either in the Xylariales or the Sordariales (*sensu* Barr, 1990).

Anamorphs can be helpful in indicating relationships of ascomycetes. The connection of *Phomatospora* to *Sporothrix,* however, is anomalous. Anamorphs that have conidia produced holoblastically from sympodially proliferating conidiogenous cells generally belong in the life cycles of species that have amyloid apical rings. Most of these fungi are classified in the Xylariales (see Samuels, Müller & Petrini, 1987; other examples are Xylariaceae and Diatrypaceae).

In this order, members of the Hyponectriaceae are leaf or wood inhabiting ascomycetes. Some of them have *Selenosporella* anamorphs that are similar to the *Sporothrix* states described here or *Microdochium* anamorphs. Ovoid, symmetric and uniseriate ascospores together with cylindrical asci in *Phomatospora* differ however from the fasciculate and usually asymmmetric ascospores in ellipsoid asci found in the Hyponectriaceae. Barr (1990) disposed *Phomatospora* in the Amphisphaeriaceae. However such placement is not consistent with the hyaline ascospore, nonamyloid but refractive apical ring nor with the anamorph.

In the Sordariales, some members of the Lasiosphaeriaceae have *Selenosporella* anamorphs with holoblastic and falcate conidia together with a synanamorph: *Ceratosporium* in *Iodosphaeria* (Samuels et al., 1987), *Endophragmiella* in *Phaeotrichospheria* (Sivanesan, 1983) or *Sporidesmium* in some species of *Lasiosphaeria* (Shomaker & White, 1986). Most of the species in the Sordariales however tend to produce their conidia in slimy masses from dark thick-walled phialides - e. g. *Chaetosphaeria* with *Chloridium*, *Codinea* and *Menispora* anamophs (Hughes & Kendrick, 1968; Gams & Holubová-Jechová, 1976), *Lasiosphaeria* with *Chloridium* (Gams & Holubová-Jechová, 1976) -

A further anomaly in *Phomatospora* is the fact that a third species, *P. dinemasporium* Webster has been linked to *Dinemasporium strigosum* (Pers.)Sacc. (Webster, 1955; as *D. gramineum* (Lib.)Lév.). There is some doubt whether *P. dinemasporium* is congeneric with *P. berkeleyi* because Webster (1955) described neither an apical ring in the asci nor the formation of striations on the ascospores. While the striations can be difficult to observe, their real absence would exclude *P. dinemasporium* from *Phomatospora*. Conidia of *Dinemasporium* species are ciliate and form from phialides in acervuli in host tissue. Such a difference in anamorphs strengthen this view. Thus, on the basis of these conflicting morphological characters, I refrain from placing *Phomatospora* into an order, pending further studies.

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FURTHER NOTES ON MATING SYSTEMS IN MELANOTUS

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ABSTRACT

Melanotus hepatochrous exhibits a unifactorial mating system, and produces asexual propagules, while M. phillipsii is tetrapolar and does not reproduce asexually in culture. The geographic range of interbreeding populations of M. eccentricus is extended to tropical Mexico. These data are compared to published reports on other Melanotus species.

To this time, mating systems in three species of Melanotus have been reported. Melanotus hartii Ammirati in Ammirati et al. (1979) and M. eccentricus (Murr.) Singer (Petersen, 1992a) have been found to be unifactorial (= bipolar), while M. defraudatus Horak et al. (1990) was reportedly bifactorial (= tetrapolar). Since those papers, two additional species of Melanotus, M. hepatochrous (Berk.) Singer and M.phillipsii (Berk. & Br.) Singer have been cultured from single-spores, and M. eccentricus has been cultured (from single spores) from tropical Mexican collections. This paper presents new data on mating systems in the genus.

MATERIALS AND METHODS

Techniques of obtaining single-spore isolates have been described previously (Petersen, 1992a, b; Petersen and Bermudes, 1992). All cultures and matings were grown on malt extract (Difco, 1.5%) agar (Difco-Bacto, 2.0%).

In the text below, five-digit TENN numbers refer to preserved herbarium specimens at the University of Tennessee, while four-digit collection numbers refer to field-book numbers assigned initially to specimens, photographs, notes and cultures.

All cultures are maintained at the University of Tennessee, and isolates of tester strains of M. hepatochrous and M. phillipsii (denoted by an asterisk in isolate lists) have been deposited in the American Type Culture Collection. Isolates of tester strains of Puerto Rican M. eccentricus were deposited at ATCC previously (Petersen, 1992a).

Abbreviations and terminology: RHP = R.H. Petersen. Cultures are abbreviated as follows: 4333:2/3/4/5 indicates single-spore isolates 2, 3, 4 and 5 of collection number 4333, all derived from a single basidioma.

All single-spore isolates under one collection number were derived from a single basidiome, and the term "self-cross" is used to denote matings of single-spore isolates from single basidiomata. Intercollection matings were performed with tester strains (representing all available mating types) from various collections, with tester strains of each collection always obtained from a single basidiome.

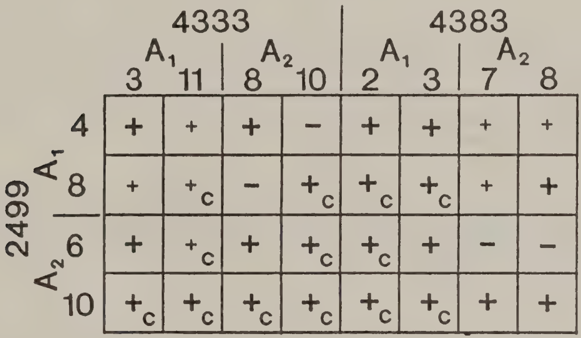
MELANOTUS ECCENTRICUS

Specimens used: MEXICO, Tabasco, vic. Teapa, Estacion Agronomica UNAM, 20.X.91, coll. RHP, on dead Musaceae, no. 4333 (TENN no. 50412); Veracruz, vic. Catemaco, UNAM Biological Station Tuxcla, 24.X.91, coll. RHP, on spiny palm, no. 4383 (TENN no. 50457).

Petersen (1992a) reported on several collections of M. eccentricus from Puerto Rico (see that paper for data on specimens utilized). In all cases the species exhibited a unifactorial mating system, and, except for a shared mating type gene between collections separated by only a few meters, tester strains of all collections were universally intercompatible.

Two additional collections of M. eccentricus were gathered in tropical Mexico. They also were found to be unifactorial and intercompatible, and intercollections matings of tester strains between Puerto Rican collection 2499 and the Mexican collections also were intercompatible, indicating that all three collections belonged to the same intersterility group (= biological species). The geographic range of potentially interbreeding populations of the fungus can be extended from the eastern Greater Antilles to tropical Mexico, with the assumption that this range will eventually prove even larger.

As seen in Fig. 1, not all intercollection matings were compatible. In several instances only sparse clamp connections were observed, and in some matings no clamp connections were seen. Moreover, in several matings, the contact zone was traversed by a line of congested submerged mycelium in a more or less typical barrage reaction. This reaction and the paucity (or absence) of clamp connection formation could not be patterned, however. Instead, there was a suggestion of strain-specific behavior, with 2499:10 not only dikaryotizing all of its mates, but causing false barrage reactions with most. Concommitantly, 4383:2/3 and 4333:3/11 dikaryotized all mates, while other strains of these collections varied in their reactions with 2499.



			4333				4383			
			A_1		A_2		A_1		A_2	
			3	11	8	10	2	3	7	8
2499	A_1	4	+	+	+	−	+	+	+	+
		8	+	$+_c$	−	$+_c$	$+_c$	$+_c$	+	+
	A_2	6	+	$+_c$	+	$+_c$	$+_c$	+	−	−
		10	$+_c$	$+_c$	$+_c$	$+_c$	$+_c$	$+_c$	+	+

Fig. 1. Intercollection mating of tester strains of Melanotus eccentricus. Collections 4333 and 4383, Mexico; 2499 Puerto Rico. Large + = abundant clamp connections; small + = few, scattered clamps. C = crystal precipitation ("false barrage").

Such reports of "partial compatibility" have been conjectured to be an indication of incipient speciation (Boidin, 1986), in which genetic barriers have occurred, but have not become prohibitive to interbreeding. In fact, the two Mexican collections were first identified as M. alpinae using the keys and descriptions by Horak (1977), in which spore width separates M. alpinae (coll. 4333: n = 15, 6.6-7.6 X 4.8-5.9 um, E = 1.29-1.50; E^m = 1.42; L^m = 7.29 um; coll. 4383: n = 15, (5.2-)5.9-7.2 X (4.1-)4.5-5.5 um, E = 1.21-1.54; E^m = 1.34; L^m = 6.62 um) from M. eccentricus (5-6 X 3-4 um; Horak, 1977). Basidiomes of one of the Mexican collections exhibited short but definite stipes, not reported for M. eccentricus, but cheilocystidial characters of the Mexican collections were very similar to those reported for M. eccentricus. Thus, Puerto Rican and Mexican collections differed somewhat at least in spore width. With such a small sampling, however, it is impossible to gauge whether morphological differences consistently parallel partial compatibility in this complex. Finally, asexual spore production by the Mexican collections was identical to that reported by Petersen (1992) for M. eccentricus.

Mating types of Mexican single-spore isolates follow: No. 4333 (Mexico): 3*, 9*, 11, 13, 14, 15 = A_1; 2, 6, 7, 8, 10*, 12 = A_2 (three isolates were dikaryon). Coll. no. 4383 (Mexico): 1, 2*, 3*, 5 = A_1; 6, 7*, 8*, 9, 10, 11, 12 = A_2 (one isolate was dikaryon).

MELANOTUS HEPATOCHROUS

Collections used: AUSTRALIA, Tasmania: Hobart, lower slopes of Mt. Wellington, 25.V.91, coll. RHP, K.W. Hughes, and A. Mills, on dead Dicksonia fronds, no. 3583 (not cultured; TENN no. 50137); 8-10 kms north of Rosebery, 30.V.91, coll. RHP & K.W. Hughes, on dead Dicksonia fronds, no. 3957 (TENN no. 50086); Hartz Mountains National Park, 5.VI.91, coll. RHP, on dead stick, no. 4017 (TENN no. 50202).

Three collections of M. hepatochrous were gathered in Tasmania, Australia, of which two were identified on the spot by Dr. Alan Mills, and all identifications later confirmed from the monograph by Horak (1977).

Self-crosses: Self-crosses in both collections showed a unifactorial mating system. Confrontation zones were characterized by frequent lethal reactions in both compatible and incompatible matings, in which significant hyphal lysis was observed within the contact zone. This reaction is frequently observed as part of the common-A ("flat") reaction in bifactorial organisms, such as Xeromphalina campanella (Petersen, 1990), but is not common in unifactorial systems.

Self-crosses in collection 4017 exhibited differentiated contact zone morphology, including reactions usually observed in bifactorial taxa ("flat," with well-defined crevasse and hyphal lysis; "barrage," in which the crevasse is bounded by raised, congested mycelium), while self-crosses in collection 3957 showed almost undifferentiated contact zones. In addition, dispersed crystalline deposition was seen in the contact zone of several self-cross pairings of 4017. When attempts were made to identify patterns for such reactions, however, none were readily resolved. Instead, they seemed to be somewhat strain-specific (i.e. produced by some single-spore isolates and not others). For example, isolates 4017:5/8 were especially assertive in producing contact zone differentiation, while other isolates were less so, or lacked this quality.

In monokaryon and dikaryon cultures of collection no. 4017, frequent arthroconidia were observed. Mode of production and morphology were precisely as previously described for *H. eccentricus* (Petersen, 1992a). No asexual propagules were observed on cultures of collection no. 3957, and, although occasional arthoconidial masses were seen in intercollection matings, they were always formed by mycelium of 4017. Production of asexual propagules might present a distinct evolutionary advantage, offering an alternative mode of dispersal not dependent on basidiome manufacture, but also not the result of meiosis and gene recombination. That this phenomenon appeared to be collection-wide [or collection-specific; that is, universal for all isolates derived from one collection (= one basidiome)] rather than isolate-specific, may indicate the presence of a suppressor present in all isolates of no. 3957. Without auxiliary markers and the ability to produce *in vitro* basidiomata, however, the genetics of asexual reproduction cannot be followed.

		4017			
		A_1		A_2	
		1	5	2	4
3951 A_1	1	+	-	+	-
	2	+	-	+	-
3951 A_2	6	+	-	+	-
	9	+	-	+	-

Fig. 2. Intercollection mating: *Melanotus hepatochrous*. Collections 3951, 4017, Tasmania, Australia. Note strain-specific dikaryotization.

Intercollection matings: Tester strains of the two collections were mated in all combinations. Compatible crosses were observed in all isolates of 3957 X 4017:1/2, while all matings involving 4017:4/5 were incompatible (Fig. 2). Because 4017:4/5 had been assigned to different mating types (A_2 and A_1 respectively) this discrepancy could not be attributed to shared mating type genes, unless at some suballelic level. Moreover, all isolates of 3957, when confronted with all tester strains of 4017, exhibited restricted growth both in colony radius and production of aerial mycelium. Although incompatible pairings were patterned, they would appear to be caused by some physiological phenomenon. Alternatively, however, based on evidence in *Marasmius* (Gordon and Petersen, 1992), *Pleurotus* (Hilber, 1982), and *Collybia* (Vilgalys, 1991), partial intercollection incompatibility is often exhibited as a strain-specific phenomenon, and this could be an explanation for the pattern seen in M. hepatochrous.

Mating type assignment: Collection no. 3957: 1*, 2*, 3, 7, 10, 11, 12 = A_1; 6*, 9*, 13, 15 = A_2. No. 4017: 1*, 5*, 7, 8, 10, 11, 12, 13 = A_1; 2*, 4*, 6, 9 = A_2.

MELANOTUS PHILLIPSII

Specimen used: SWEDEN, Vastergotland, vic. Gothenburg, Bokedalen Forest, 25.IX.91, coll. Scott Gordon, on dead grass leaves, no. 4275 (TENN no. 50611).

One collection of this European species was made in southwestern Sweden. Identification was made by reference to the generic monograph by Horak (1977), who had examined only one previous collection from Sweden.

Culture characteristics: Common hyphal tips were seen to be encrusted with minute brownish crystals. These hyphal tips were always submerged, and the crystals diminished in number with distance from the immediate area of the hyphal tips.

No evidence of asexual propagule production was seen, but spherical inflated cells were occasionally produced either terminally or intercalary. No evidence for thick walls could be seen, so these structures could not be termed chlamydospores.

All cultures produced a strong odor of unripe corn or corn shucks.

Self-cross: An initial self-cross of 12 single-spore isolates from one basidiome produced a grid showing a bifactorial mating system, but represented by only three mating types. Three additional monokaryon isolates from the same basidiome were crossed with tester strains of the three mating types, and the fourth mating type was obtained. The adjusted self-cross grid for M. phillipsii (Fig. 3) was very similar to that produced by M. defraudatus (Fig. 4; not previously published), which, in turn, served as the basis for the report of bifactorial mating system in that species (Horak et al., 1990). One isolate (2054:2) presumably incorporated two mating types. A further complication may be seen in isolates 6, 8 and 9, the mating types of which were interchangable. In Fig. 4, isolate 6 is accepted as mating type A_1B_2, dictating that isolates 8 and 9 are A_2B_1, but any combination of two isolates can be judged to be the opposite mating type from the third. Whichever combination is accepted, however, the grid must be interpreted as tetrapolar. The similar grid for M. phillipsii no longer leaves M. defraudatus as the only bifactorial species in the genus.

Mating type assignments follow: 1*, 14, 15 = A_1B_1; 3*, 5, 11 = A_2B_2; 7, 8* = A_1B_2; 10* (restricted growth) = A_2B_1. Isolates 6 and 9 were dikaryons; isolates 2 and 12 were A_2B_2 + A_2B_1. While flat and barrage reactions were noted, they could not be patterned, and subordinate mating types (A_1B_2; A_2B_1) were assigned arbitrarily.

	A_1B_1			A_2B_2				A_1B_2			A_2B_1	A_2B_2+ A_2B_1		DIK	
	1	14	15	5	11	3	13	7	8	4	10	2	12	6	9
1		–	–	+	+	+		–	–			+	+	+	+
14	–		–	+	+	+		–	–			–	+	+	+
15	–	–		+	+	+	+	–	–	–	–	+	+	+	+
5	+	+	+		$\overline{F}$	$\overline{B}$		–	–			$\overline{B}$	–	+	+
11	+	+	+	$\overline{F}$		$\overline{B}$		–	–			$\overline{B}$	$\overline{F}$	+	+
3	+	+	+	$\overline{B}$	$\overline{B}$			$\overline{F}$	$\overline{F}$			$\overline{B}$	$\overline{B}$	+	+
13			+						$\overline{B}$				–		
7	–	–	–	–	–	$\overline{F}$			–			+	+	+	+
8	–	–	–	–	–	$\overline{F}$	$\overline{B}$	–		–	+	+	+	+	+
4			–						–				+		
10			–						+				–		
2	+	–	+	$\overline{B}$	$\overline{B}$	$\overline{B}$		+	+				$\overline{B}$	+	+
12	+	+	+	–	$\overline{F}$	$\overline{B}$	–	+	+	+	–	$\overline{B}$		+	+
6	+	+	+	+	+	+		+	+			+	+		+
9	+	+	+	+	+	+		+	+			+	+	+	

Fig. 3. Self-cross: Melanotus phillipsii. Large + = abundant clamp connections; small + = few, scattered clamps. F = flat morphology; B = barrage morphology; blank squares = crosses not performed.

DISCUSSION

Of the species of Melanotus for which mating systems and asexual reproduction have been assayed, two species, M. defraudatus and M. phillipsii lack asexual spore production, while M. eccentricus, M. hartii, and M. hepatochrous produce arthroconidia of identical morphology and mode of production. That the former two exhibit a bifactorial mating system, and the latter three are unifactorial would seem more than coincidental.

	A_1B_1			A_2B_2			A_1B_2	A_2B_1		A_2B_2 + A_1B_2
	4	5	10	1	3	7	6	8	9	2
4		-	-	+	+	+	-	-	-	+
5	-		-	+	+	+	-	-	-	+
10	-	-		+	+	+	-	-	-	+
1	+	+	+		-	-	-	-	-	-
3	+	+	+	-		-	-	-	-	-
7	+	+	+	-	-		-	-	-	-
6	-	-	-	-	-	-		+	+	-
8	-	-	-	-	-	-	+		+	+
9	-	-	-	-	-	-	+	+		-
2	+	+	+	-	-	-	-	+	-	

Fig. 4. Self-cross: Melanotus defraudatus. Note: Mating types for isolates 6, 8 and 9 are interchangable.

An obvious advantage of asexual reproduction is as a means of spreading inoculum without investment in basidiome production. This advantage would be compounded for an organism which is amphithallic, homothallic, or clonal, and thus able to form basidiomata from "primary" mycelium without anastomosis and dikaryotization. None of the species of Melanotus seem so, unless the double mating-type single-spore isolates of M. phillipsii (and possibly M. defraudatus) are accepted as a tendency toward amphithallism (see below).

If judged from a within-individual perspective, moreover, asexual reproduction might be an advantage to a bifactorial organism, where compatible matings between sibling germlings are accomplished at a rate of 25%. More copious (asexual) inoculum would enhance the chances of encounters between compatible mycelia. In unifactorial organisms, within-collection compatibility is at a rate of 50%, thus presumably reducing the advantage of asexual reproduction. Dr. J. Ammirati (pers. comm.) has found that M. hartii produces both haploid and dikaryon asexual propagules, as well as haploid and dikaryon basidiomes. Thus, all possible modes of propagule production are exploited, presumably of added benefit in a colonizing strategy. It is the three unifactorial species of Melanotus, however, which exhibit asexual reproduction.

From the standpoint of intercollection matings (i.e. interbreeding between scattered populations of the fungus), given almost universal intercollection compatibility, asexual reproduction would seem to furnish more inoculum of already universally compatible strains. At the very least, however, presence of asexual reproduction may be added to species-level diagnostic taxonomic characters in the genus.

Occurrence of "single-spore isolates" with double mating-type breeding pattern seems limited, thus far, to the two bifactorial species. Such data may have been an artifact of faulty technique in harvesting single-spore germlings, but could also be caused by an occasional double nuclear migration from basidium to basidiospore, which, if random, would also produce some dikaryon basidiospores of like or opposite mating types. Such spores would represent amphithallic behavior, and would enhance the probability of dikaryotization and, therefore, of basidiome production. While this line of reasoning may be spurious (examination of squashed lamellae under epifluorescence microscopy did not reveal plurinucleate basidiospores; there is no way to prove or disprove the idea based on materials in hand), it also leads to a construct in which such amphithallic behavior might reduce the need for asexual spore production.

While consistency of mating systems at the genus level in agarics seems most common, the number of genera in which more than one mating system occurs appears to be increasing as more taxa are investigated. Although no comparable scheme has been presented for gilled basidiomycetes, Boidin (1971, 1986) offered a series of conclusions in which unifactorial mating systems were considered more highly evolved than bifactorial, and showed that within several genera of corticioid fungi such inconsistency of mating systems occurred.

In the formulation of modern systematic concepts, a dichotomous choice may proceed from such data: either coherent morphotaxonomic groups can be accepted with more than one mating strategy, or groups can be defined by mating systems, leading to occasional segregation of otherwise coherent morphotaxonomic complexes.

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THE FUNGUS HERBARIUM OF THE UNIVERSITY OF MASSACHUSETTS AT AMHERST (MASS)

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ABSTRACT

The Fungus Herbarium of the University of Massachusetts at Amherst (MASS) was donated to the New York Botanical Garden (NY) in June 1989. The history and the contents of the collections are briefly described. The most valuable parts of the herbarium are collections assembled by M. E. Barr and H. E. Bigelow during their appointments at the University of Massachusetts. The MASS collections have now been incorporated into the NY collections, and a list of type specimens, formerly represented in the MASS Fungus herbarium is presented. A large number of well documented, but undetermined Agaricales specimens can be made available for determination.

INTRODUCTION

After the retirement of Margaret E. Barr in June 1989, the fungus Herbarium of the University of Massachusetts at Amherst (MASS) was donated to the New York Botanical Garden (NY). The carefully curated and well-maintained collection contains approximately 40,000 specimens of fungi, including lichens. Most of them were collected by Howard E. Bigelow and Margaret E. Barr during their tenure of more than 30 years in the Botany Department of the University of Massachusetts at Amherst. The herbarium also contains some historical collections and 295 type specimens. The history and contents of the MASS Fungus Herbarium is described below, and a list of type specimens is presented.

The University of Massachusetts herbarium was established about 1900. The University was at that time known as the Massachusetts Agricultural College. The mycological portion of the herbarium grew at first primarily by the acquisition of sets of collections, which were probably purchased. Early staff members and associates contributed some local collections as well, especially of plant pathogens. Prominent collectors and collections of the early days of the MASS Fungus Herbarium are listed in Table 1.

TABLE 1

IMPORTANT COLLECTORS AND EXSICCATAE REPRESENTED IN THE FUNGUS HERBARIUM OF THE MASSACHUSETTS AGRICULTURAL COLLEGE

Non-lichenized Fungi:

Anderson, P. J.
Arthur, J. C. and E. W. D. Holway, Uredineae Americanae Exsiccatae
Bartholomew, E., Kansas Fungi
Bartholomew, E., North American Uredinales
Blake, J.
Commons, A. A.
Davis, J. J.
Davis, W. W.
Denslow, W. W.
Doran, W. L.
Ellis, J. B., North American Fungi
-----, Fungi Columbiani
Farlow, W. G.
Frost, C. C.
Grant, J.
Griffiths, D., West American Fungi
Guba, E. F., Fungi of Nantucket
Halsted, B. D., New England Fungi
Hesler, L. H.
Humphrey, J. E.
Kellerman, W., Ohio Fungi
Laird, K.
Matz, J.
Muller, W. O.
Murrill, W. A.
Osmun, A. V.
Pammel, L. H., Iowa
Parks, H. E., Californian Fungi
Pringle, C. G., Mexican Fungi
Ravenel, H. W., Fungi Caroliniani Exsiccati
Seymour, A. B., Economic Fungi
Shear, C. L., New York Fungi
Smith, A. H.
Sproston, T.
Weber, G. F.
Whetzel, W.
Wilson, G. W. and F. J. Seaver, Ascomycetes and Lower Fungi

Lichenized fungi:

Clark, A.
Cobb, N. A. & A. V., Williston Seminary Herbarium (Easthampton, MA)
Cummings, C. E. et al., Decade of North American Lichens
Denslow, W. W.
Mueller, W. O., Kryptogamen Herbar der Thueringischen Staaten
Stone, G. E.

Howard Bigelow was the first mycologist hired by the Botany Department. He joined the staff in 1957, and Margaret Barr, who arrived with Bigelow, was hired a few years later. Originally, the entire University of Massachusetts herbarium was housed together in very cramped quarters in Clark Hall. When the new Morrill Science Center was completed in 1963, the fungi were given separate quarters in the new building, near the mycology laboratory and offices. The collections were moved into 18 double-door Interior Steel herbarium cases that housed the fungal specimens until their transfer to the New York Botanical Garden. At the time of this move, the mycological collections, including lichens, totalled 18,444 specimens.

Under the careful management of Bigelow and Barr, many of these older collections were repaired and reidentified. Due to the yearly collection efforts of these two mycologists, the herbarium began to grow rapidly. Most of the collections are the results of summer collecting trips in the New England states. The fungus flora in and around Baxter State Park (Penobscot Co.) and near Carrabasset Village (Franklin Co.) in Maine was documented over several decades. Other important collection sites were around South Conway and in the White Mountains National Forest, New Hampshire, and around Mt. Mansfield in Lamoille Co., Vermont. The other New England states Connecticut and Rhode Island were visited on many shorter trips. Much frequented collection sites at home in Massachusetts were Mt. Toby (Franklin Co.), Amherst (Hampshire Co.) and Conway (Franklin Co.). Both Bigelow and Barr also collected extensively in the Gaspé Province Park in Quebec in the summer of 1957, and many new species were described from these collections. Collections were also made in other parts of the country, such as California, Michigan, Florida, Arizona, and New York, and on two trips to Europe. Additionally, an active exchange program with other mycologists increased the diversity of species represented in the herbarium.

Howard Bigelow's research centered on the very large agaric family Tricholomataceae, particularly the genus *Clitocybe*. These fungi are well represented in the herbarium. He was also interested in the fleshy fungus flora of New England and northeastern North America in general. Bigelow's collections are noteworthy for the quality of their preservation and determination. A large collection of photographs, negatives, and note cards accompanies his collections.

Margaret Barr has focused her career on pyrenomycetes and loculoascomycetes. She is one of the most prominent and highly respected specialists on these inconspicuous, but often economically important fungi, and therefore collections made or determined by her have a special significance in ascomycete taxonomy. Particularly well represented among her collections are *Gnomonia* and *Venturia* and their segregates.

In the 1960s, Amherst College gave its herbarium on permanent loan to the University of Massachusetts. Although flowering plants predominate in this herbarium, it contains some fungi (mostly from exsiccatae) and approximately 400 lichen specimens, which appear to be duplicates from the Tuckerman Herbarium. Edward Tuckerman (1817-1886), the best known and most influential American lichenologist of his day, taught for many years at Amherst College. The main portion of his herbarium is on deposit at the Farlow Herbarium of Harvard University (FH). Some of the Amherst College collections were reidentified and inserted into the general MASS Fungus Herbarium by Barr and Bigelow, but some, especially the lichens, had not been intercalated.

Another addition to the MASS Fungus Herbarium was the herbarium of the Boston Mycological Club, the oldest amateur mycological organization in North America. These collections, mostly of agarics, were donated to the University in the late 1970s, and were being reviewed by Howard Bigelow at the time of his death.

The MASS Fungus Herbarium was mostly arranged in systematic order with the Loculoascomycetes, Ascomycetes, Agaricales, Boletales, Polypores, and Deuteromycetes being the largest groups. Within each of the groups, genera were arranged alphabetically, and the species were arranged alphabetically within each genus. As mentioned above, significant portions of the Amherst College Herbarium, the herbarium of the Massachusetts Agricultural College, and the Herbarium of the Boston Mycological Club had been reboxed or repacketed, and annotated by either Bigelow or Barr, and were interfiled with the general collections. However, large portions of these herbaria were still kept separately at the time of the transfer. These collections consisted largely of exsiccatae sets that were not annotated, and that are duplicated at NY. About 10,000 of these duplicates will be available for exchange.

Most of the MASS fungi were filed either in loose packets (with labels glued on) or, for larger fungi, in boxes. Boxed and packeted specimens were all in exceptionally good condition, and only a few needed repair. All specimens were stamped with a stamp indicating that the specimen was originally part of the MASS herbarium, and the year of its deposition in NY. Many of the boxes holding larger fungi contained naphthalene crystals which had to be removed prior to the incorporation into the NY collections. The integration of the MASS Fungus Herbarium has now been completed. As a result of M. E. Barr's research on Loculoascomycetes and in order to accomodate her large collection adequately, the NY collection of Loculoascomycetes is currently being rearranged according to her taxonomic system (Barr, 1987).

Among the unidentified fungi was a well-preserved and well-documented collection of 2825 unidentified Agaricales, mostly collected by H. E. Bigelow. Most of them contain spore prints and notes on the fresh condition. A database was established containing information pertinent to the determination of the collections, including cross-references to the note cards, and the files of photographs and 4x5 negatives. A list of these collections is available, and the specimens including the corresponding cards and photos can be made accessible to specialists. The database will be used later to generate labels for the determined collections.

Type specimens represented in the Fungus Herbarium of the Univeristy of Massachussets at Amherst (MASS) now deposited at the New York Botanical Garden (NY)

Prior to the transfer to NY, approximately 125 holo- and isotypes were estimated to be deposited at MASS. During the integration of the collection, however, many more specimens were verified as types, many of which are exsiccatae material of the North American Fungi edited by Ellis, and Ellis and Everhart. Although duplicated at NY, these specimens are of particular value, since most of them have been annotated by M. E. Barr and are voucher specimens for much of her research. Many new combinations have been based on them.

A total of 302 fungus type specimens have been found in the mycological portion of the MASS herbarium. Most of them are Loculoascomycetes and Hymenoascomycetes representing many new species described by M. E. Barr. There is also a large number of *Clitocybe* types (Agaricales), most of which were described by H. E. Bigelow in his monograph of the genus (1982, 1985). A few type specimens represent species newly described by Bigelow's and Barr's doctoral students T. J. Baroni, J. R. Boise, W. Cibula, and R. E. Halling. All type specimens have been verified and incorporated into the NY collections.

In the following list of type specimens of the MASS Fungus Herbarium, nine suprageneric groups are distinguished: Chytridiomycetes, Zygomycetes, Ascomycetes, Uredinales, Aphyllophorales, Agaricales, Hyphomycetes, Coelomycetes. The basionyms are listed in alphabetical sequence within each group, followed by the bibliographic citation of their first publication. Label information including locality data, hosts, date of the collection, collector's name, and collection number is listed in a second paragraph, followed by a brief description of the kind of type. Frequently, the type specimen is called a 'possible isotype' or a 'possible syntype'. Such specimens usually are part of an exsiccatae, and the exsiccatae number is not mentioned in the original publication. However, all the other label data agree with the type description, and therefore, it was assumed that our specimen is likely to represent a type collection of the species. Paratypes are generally not included in this list, although paratypes of Agaricales are housed with the type collections at NY. Up to three synonyms are listed for each basionym, but no attempt was made to provide a complete list of synonyms. In a few cases, other noteworthy details about the specimen are provided.

TABLE 2

TYPE SPECIMENS REPRESENTED IN THE MASS FUNGUS HERBRIUM NOW DEPOSITED AT THE NEW YORK BOTANICAL GARDEN (NY)

Abbreviations: NAF = North American Fungi, Fungi Col. = Fungi Columbiani

Chytridiomycetes

Physoderma dulichii R. M. Johns, Mycologia 49: 298. 1957.
In the upper epidermis of leaves of *Dulchium arundinaceum*. U. S. A.: Michigan, Cheboygan Co., Smith's Bog, 30 Jun 1956, R. M. Johns s.n. (SYNTYPE).

Zygomycetes

Endogone flammicorona Trappe & Gerdemann, Trans. Brit. Mycol. Soc. 59: 405. 1972.
In nursery beds of *Pinus strobus* and *Picea abies*. Italy: Novara Province, Prato Sesia Nursery, 25 Oct 1967, Trappe 1172 (ISOTYPE).

Glomus convolutus Gerdemann & Trappe, Mycologia Memoir 5: 42. 1974.
On soil or conifer needles and rotted wood near melting snowbanks. U. S. A.: California, Del Norte Co., Sanger Lake, 29 Jun 1971, Trappe 2778 (ISOTYPE).

Ascomycetes

Acanthostigmella pallida Dennis & Barr, Mycotaxon 6: 21. 1977.
On old *Hypoxylon mammatum* on *Salix sp.* England: Wiltshire, 19 Oct 1976, J. B. Hindley s.n., comm. R. W. G. Dennis (ISOTYPE).

Acanthostigmella pellucida Barr, Mycotaxon 6: 21. 1977.
On overwintered parts of *Taxus canadensis*. Canada: Quebec, St. Gregoire, Mt. Johnson, 27 Jul 1957, Barr 1873 (HOLOTYPE).

Aigalus parvus S. Schatz & J. Kohlmeyer, Trans. Brit. Mycol. Soc. 85: 704. 1985.
On *Rhizophora mangle*. U. S. A.: Florida, Miami Beach, sublittoral, 24 Jul 1984, Schatz s.n., ex Herb. IMS 287 and 287b (Two ISOTYPES).

Amphisphaeria dothideaspora Cooke & Harkness, Grevillea 14: 9. 1885.
On dead branches of *Mimulus glutinosus*. U. S. A.: California, San Francisco, s.d., Harkness s.n., NAF 1662 (Possible SYNTYPE).

≡ *Mycomicrothelia dothideaspora* (Cooke & Harkness) D. L. Hawksworth, Bull. Brit. Mus. <Nat. Hist.> Bot. 14: 82. 1985.

Hawksworth designates Harkness 2508 as the lectotype. It is not clear whether our specimen is Harkness 2508 or Harkness 2217, which are the only two collections of this species.

Antennularia alpina var. *major* Barr, Canad. J. Bot. 46: 850. 1968.

On dead branches and leaf bases of *Arctostaphylos alpina*. Canada: Quebec, Gaspé Prov. Park, top of Mt. Albert, 8 Jul 1957, Barr 1969C (HOLOTYPE).

≡ *Protoventuria alpina* (Sacc.) Barr var. *major* (Barr) Barr, Canad. J. Bot. 49: 1960. 1971.

≡ *Protoventuria major* (Barr) B. Eriksson, Svensk Bot. Tidskr. 68: 222. 1974.

≡ *Antennularia major* (Barr) P. Remler, In: Ascomyceten auf Ericaceen in den Ostaplen. Bibl. Mycologica 68: 146. 1979 (1980).

The combination *Protoventuria major* (Barr) Barr (Sydowia 41: 37. 1989) is superfluous.

Antennularia latispora Barr, Canad. J. Bot. 46: 851. 1968.

On overwintered leaves of *Phyllodoce coerulea*. Canada: Quebec, Gaspé Prov. Park, top of Mont Albert, 22 Aug 1957, Barr 2272 (HOLOTYPE).

≡ *Protoventuria latispora* (Barr) Barr, Canad. J. Bot. 49: 1960. 1971.

≡ *Gibbera latispora* (Barr) L. Holm, Svensk Bot. Tidskr. 69: 152. 1975.

Antennularia ledi Barr, Canad. J. Bot. 46: 852. 1968.

On dead leaves and branches of *Ledum groenlandicum*. Canada: Quebec, Gaspé Prov. Park, top of Mont Albert, 8 Jul 1957, Barr 1963 (HOLOTYPE).

≡ *Protoventuria ledi* (Barr) Barr, Canad. J. Bot. 49: 1959. 1971.

Antennularia variisetosa Barr, Canad. J. Bot. 46: 850. 1968.

On leaves stems and capsules of *Ledum groenlandicum*. U. S. A.: Maine, Baxter State Park, Sandy Stream Pond, 28 Jun 1962, Barr 3255A (HOLOTYPE).

≡ *Protoventuria variisetosa* (Barr) Barr, Canad. J. Bot. 49: 1960. 1971.

Apiognomonia alniella var. *ribis* Barr, Mycologia Memoir 7: 26. 1978.

On overwintered leaves of *Ribes hirtellum* var. *saxosum*. Canada: Quebec, Gaspé Province Park, Mt. Albert, trail near falls, 7 Jul 1957, Barr 1925b (HOLOTYPE).

= *Apiognomonia ribis* (Barr) Monod, Beih. Sydowia 9: 58. 1983.

Apiognomonia tiliae var. *magnoliae* Barr, Mycologia Memoir 7: 28. 1978.

On overwintered leaves of *Magnolia soulangeana*. U. S. A.: Massachusetts, Amherst, University campus, 22 May 1961, Barr 2900 (HOLOTYPE).

≡ *Apiognomonia magnoliae* (Barr) Barr, Mycotaxon 41: 287. 1991.

Asterina carnea Ell. & Martin, Amer. Naturalist 17: 1284. 1883.

On living leaves of *Persea palustris*. U. S. A.: Florida, Green Cove Springs, Feb 1883, G. Martin s.n., NAF 1290 (Possible ISOTYPE).

≡ *Phaeoschiffnerula carnea* (Ell. & Martin) v. Höhnel, Ann. Mycol. 15: 364. 1917.

≡ *Rhytidenglerula carnea* (Ell. & Martin) v. Höhnel, Sitzungsberichte Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1, 127: 386. 1918.

≡ *Schiffnerula carnea* (Ell. & Martin) Petrak, Ann. Mycol. 16: 398. 1928.

NAF 1290 is not mentioned in the publication, however, Martin mentions NAF 1290 as the only collection of this species (J. Mycol. 1: 134. 1885).

Asterina celastri Ell. & Kellerman, J. Mycol. 1: 3. 1885.

On living leaves of *Celastrus scandens*. U. S. A.: Kansas, Manhattan, Nov 1884, Kellerman s.n., NAF 1542 (Possible ISOTYPE).

This is probably identical with *Schizothyrium pomi* (Mont.:Fr.) v. Arx, although immature (M. E. Barr, pers. comm.).

Asterina globifera Ell. & Ev., Bull. Torrey Bot. Club 22: 435. 1895.

On leaves of *Grevillea sp.* U. S. A.: Hawaiian Islands, Oahu, 18 Mar 1895, Heller Hawaiian Fungi 1946 (ISOTYPE).

≡ *Euthrypton globiferum* (Ell. & Ev.) Theissen, Verh. Zool. Bot. Ges. Wien 66: 323. 1916.

≡ *Atichia globifera* (Ell. & Ev.) Petrak, Ann. Mycol. 26: 392. 1928.

≡ *Seuratia globifera* (Ell. & Ev.) Meeker, Canad. J. Bot. 53: 2489. 1975. See this publication for complete synonymy.

Asterina ilicis Ell., Amer. Naturalist 17: 319. 1883.

On living leaves of *Ilex glabra*. U. S. A.: New Jersey, Newfield, Jun 1882, NAF 1357 (Possible ISOTYPE).

≡ *Microphyma ilicis* (Ell.) Speg., Bol. Acad. Nac. Ci. 11: 552. 1889.

≡ *Henningsiella ilicis* (Ell.) v. Höhnel, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1, 118: 363. 1909.

NAF 1357 is not mentioned in the species description, however, G. W. Martin mentions NAF 1357 as the only specimen of this species (J. Mycol. 1:135. 1885). Herbarium label is annotated by Barr as *Schizothyrium perexiguum* (Rob.) v. Höhnel.

Asterina lepidigena Ell. & Martin, Amer. Naturalist 18: 1148. 1884.

Attached to the epidermal scales on living leaves of *Andromeda ferruginea*. U. S. A.: Florida, Green Cove Springs, Mar 1884, G. Martin s.n., NAF 1361 (Possible ISOTYPE).

NAF 1361 is not mentioned in the publication, however, G. W. Martin mentions NAF 1361 as the only specimen (J. Mycol. 1: 136. 1884). Herbarium label is annotated by Barr as *Phillipsiella atra* Cooke.

Asterina patelloides Ell. & Martin, J. Mycol. 1: 136. 1885.

On living leaves of *Quercus laurifolia*. U. S. A.: Florida, Green Cove Springs, Mar 1883, G. Martin s.n., NAF 1359 (ISOTYPE).

NAF 1359 was distributed as *Asterina erysiphioides* Ell. & Martin, which is later a homonym of *A. erysiphioides* Kalch. & Cooke. The label is annotated by Barr as *Plochmopeltis intricata* (Ell. & Martin) Theissen.

Asterina pinastri Ell. & Sacc., Michelia 2: 567. 1882.

In fallen tree tops, on dead, but still attached leaves of *Pinus rigida*. U. S. A.: New Jersey, Newfield, Apr 1879, Ellis NAF 789 (Possible ISOTYPE).

≡ *Phaeocryptopus pinastri* (Ell. & Sacc.) Petrak, Ann. Mycol. 36: 25. 1938. See Barr, Canad. J. Bot. 46: 844. 1968. for complete synonymy.

Asterina plantaginis Ell., Bull. Torrey Bot. Club 9: 74. 1882.

On living leaves of *Plantago major*. U. S. A.: Pennsylvania, Philadelphia, Oct 1881, G. A. Rex s.n., NAF 791 (Two ISOYPES).

≡ *Coleroa plantaginis* (Ell.) Barr, Canad. J. Bot. 46: 833. 1968.

≡ *Hormotheca plantaginis* (Ell.) Corlett & Barr, Mycotaxon 25: 255-257. 1986. See there for complete synonymy.

Asterina triloba Earle, Bull. New York Bot. Gard. 3: 310. 1905.

On living leaves of *Croton discolor*. Porto Rico: limestone hills along the coast 3 mi W of Ponce, 5 Dec 1902, A. A. Heller 6216 (ISOTYPE).

Astrosphaeriella floridana Barr, North American Flora II, 13: 27. 1990.

On petioles of *Sabal palmetto*. U. S. A.: Florida, Gainesville, University of Florida, Horticultural Farm, 10 Aug 1985, Barr 7058 (HOLOTYPE).

Astrosphaeriella venezuelensis Barr & D. L. Hawksworth, J. Linn. Soc., Bot. 82: 51. 1981.

Unidentified host, probably a bamboo. Venezuela: Sucre, trail from Los Pocitos, through La Roma to town of Rio Grande Arriba, 13 Jul 1972, Dumont-VE 5030 (ISOTYPE).

Bimuria novae-zelandiae D. L. Hawksworth, Chea & J. E. Sheridan, New Zealand J. Bot. 17: 268. 1979.

Isolated from soil. New Zealand: North Island, Nutty Farm, Wairarapa, 3 Mar 1978, Chea & Sheridan s.n., IMI 229814 (ISOTYPE).

Botryosphaeria hyperborea Barr, Mycologia 62: 383. 1970.

On leaf of *Empetrum nigrum*. Canada: Newfoundland, Seal Cove Point, 12 Jul 1957, R. T. Wilce s.n. (HOLOTYPE).

Botryosphaeria spiraeae Barr, Contr. Univ. Michigan Herb. 9: 560. 1972.

On overwintered leaves of *Spiraea latifolia*. U. S. A.: Vermont, Lamoille Co., Johnson, Neighborhood Trail, 11 Aug 1964, Barr 4499 (HOLOTYPE).

Byssosphaeria barbicincta Ell. & Ev., J. Mycol. 4: 63. 1888.

Parasitic on old *Diatrype tremellophora* and adjoining bark on *Magnolia sp.* U. S. A.: New Jersey, Newfield, Oct 1887, NAF 1958 (ISOTYPE).

≡ *Trichosphaeria barbicincta* (Ell. & Ev.) Sacc., Sylloge Fungorum 9: 603. 1891.

≡ *Herpotrichia barbicincta* (Ell. & Ev.) Ell. & Ev., North Amer. Pyrenomycetes p.158. 1892.

≡ *Niesslia barbicincta* (Ell. & Ev.) Barr in Bigelow & Barr. Rhodora 65: 305. 1963.

= *Chaetosphaeria* Barr ined.

Byssosphaeria oviformis Barr, Mycotaxon 20: 31. 1984.

On blackened decorticated wood. Jamaica: Trelawney Parish, vicinity of Windsor, 21 Apr 1981, W. R. Buck 5949 (ISOTYPE).

Calosphaeria cornicola Ell. & Ev., Proc. Acad. Nat. Sci. Phil. 1894: 342. 1894.

On dead limbs of *Cornus asperifolia*. U. S. A.: Kansas, Rockport, 23 May 1894, E. Bartholomew s.n., NAF 1470 (ISOTYPE).

≡ *Togninia cornicola* (Ell. & Ev.) Berl., Icon. Pyren. 3: 11. 1900.

This collection is annotated by Barr as *Togninia* cf. *villosa* (Nits.) Berl. along with *Fenestella minor* on the same collection.

Chaetomastia equiseti Barr, Mycotaxon 34: 510. 1989.

On old stalks of *Equisetum hiemalis*. U. S. A.: Maine, Franklin Co., Carrabassett, Spring Farm, 30 Aug 1971, Barr 5857 (HOLOTYPE).

Chaetomium causiaeforme L. M. Ames, Mycologia 41: 644. 1949.

Isolated by G. W. Martin from leather sweat band of helmet liner from Guadalcanal. Culture: QM ex ATCC 11198, ex DAOM 24186, ex JQMD (Jeffersonville Quartermaster Depot), s.d., cult. by E. G. Simmons, Oct 1983. (Culture from TYPE).

Chaetomium cupreum L. M. Ames, Mycologia 41: 642. 1949.

Origin unclear, see below. Culture: subculture of an isolate studied by L. M. Ames, 1949, s.d., culture isolated by J. C. Cooke on 9 Jan 1973, from A69 (Culture from TYPE).

≡ *Chaetomium trilaterale* var. *cupreum* (L. M. Ames) J. C. Cooke. Based on subculture obtained from type culture (freeze dried specimen). Mycologia 65: 1218. 1973.

Ames originally studied two isolates from different localities, Panama and Guadalcanal, and no culture number is mentioned in the publication. It is not clear which of the two collection was examined by J. C. Cooke. The specimen collected in the Panama Canal Zone, s.d., was chosen to be the lectotype by L. M. Ames in: A monograph of the Chaetomiaceae. The United States Army Research and Development Series 2: 21. 1961.

Chaetomium microcephalum L. M. Ames, Mycologia 37: 145. 1945.

Isolated by Ames from plant debris. U. S. A.: Tennessee, Cades Cove, The Great Smoky Mountains, QM ex DAOM 24959, ex Ames 1045, s.d., cultured by E. G. Simmons, Oct 1983. (Culture from TYPE).

= *Chaetomium botrychodes* Zopf, fide von Arx, Guarro & Figueras, Beih. Nova Hedwigia 84: 63. 1986.

Chaetomium ochraceum Tschudy, Amer. J. Bot. 24: 475. 1937.

Isolated by Tschudy from decomposing reeds. U. S. A.: Washington, QM ex DAOM 35544, ex Ames 1044.5, ex R. H. Tschudy s.n., s.d., Cultured by E. G. Simmons. Oct 1983. (Culture from TYPE).

= *Chaetomium globosum* Kunze, fide von Arx, Guarro & Figueras, Beih. Nova Hedwigia 84: 29. 1986.

Chaetomium pusillum Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1890: 220. 1890.

On basswood barrel bottom. U. S. A.: New Jersey, Newfield, in a cellar, Jul 1889, NAF 2350. Non *C. pusillum* Fr., Syst. Mycol. 3: 255. 1829. (ISOLECTOTYPE).

≡ *Chaetomium ellisianum* Sacc. & Sydow. Sylloge Fungorum 14: 491. 1899. Nom. nov. for *C. pusillum* Ell. & Ev. (1890) non Fr. (1829).

≡ *Ascotricha pusilla* (Ell. & Ev.) Chivers, Mem. Torrey Bot. Club 14: 220. 1915.

≡ *Ascotricha ellisiana* (Sacc. & Sydow) D. L. Hawksworth, Trans. Brit. Mycol. Soc. 54: 522. 1970.

= *Ascotricha amphitricha* (Corda) Hughes, fide D. L. Hawksworth, Mycol. Pap. 126: 10. 1971.

Chaetomium trilaterale var. *chiversii* J. C. Cooke, Mycologia 65: 1218. 1973.

Isolate obtained by Dr. R. Jackson from peanut shells. U. S. A.: Georgia, Tift County, Jul 1965, Subcultured by J. C. Cooke on 9 Jan 1973. (ISOTYPE).

≡ *Chaetomium chiversii* (J. C. Cooke) Carter, Beih. Nova Hedwigia 84: 19-20. 1986.

The name is based on a dried specimen of Cooke's subculture.

Chaetomium trilaterale var. *diporum* J. C. Cooke, Mycologia 65: 1218. 1973.

Unidentified isolate. unkown locality: subculture sent to L. M. Ames by J. H. Miller, Miller 1713, June 1958, Subcultured by J. C. Cooke on 9 Jan 1973 from A332 (ISOTYPE).

= *Chaetomium aureum* Chivers, fide v. Arx, Guarro & Figuerro, Beih. Nova Hedwigia 84: 15. 1986.

The name is based on a dried specimen of Cooke's subculture.

Chaetosartorya stromatoides Wiley & Simmons, Mycologia 65: 935. 1973.

Isolated from forest soil. Thailand: Pak Thong Chai, Apr 1967, Simmons s.n., QM 8944 (ISOTYPE).

Cilioplea coronata ssp. *montana* Barr, Mem. New York Bot. Gard. 62: 56. 1990.

On twigs of *Artemisia tridentata*. U. S. A.: Colorado, Grand Co., Granby, county road 63, 11 Aug 1984, M. Blackwell 1915a (HOLOTYPE).

Clypeosphaeria americana Barr & G. J. Samuels, Systema Ascomycetum 8: 6. 1989.

In periderm of *Fraxinus sp.* U. S. A.: North Carolina, Graham Co., Slickrock Wilderness Area, trail to Slickrock Creek along Lake Caulderwood, mixed hardwood, 3 Oct 1987, R. C. Harris 20908 (ISOTYPE).

Cucurbitaria insecura Ell., Sylloge Fungorum 2: 322. 1883.

On *Salix*. U. S. A.: Utah, Pleasant Valley, 1881, S. J. Harkness s.n., NAF 882 (ISOTYPE).

≡ *Strickeria insecura* (Ell.) Kuntze, Rev. Gen. Pl. 3: 534. 1898. See Barr, North American Flora II, 13: 23. 1990. for complete synonymy.

Cucurbitaria umbilicata Ell., Bull. Torrey Bot. Club 10: 53. 1883.

On decorticated sage brush. U. S. A.: Utah, , s.d., S. J. Harkness s.n., NAF 1654 (Possible ISOTYPE).

≡ *Chaetoplea umbilicata* (Ell.) Barr, Mem. New York Bot. Gard. 62: 54. 1990.

This collection is annotated by Barr as *Teichospora solitaria* (Ell.) Ell. & Ev.

Diadema hexamerum R. A. Shoemaker & C. E. Babcock, Canad. J. Bot. 67: 1353. 1989.

On *Poa epilis*. U. S. A.: California, Siskiyou Co., Mt. Shasta, N of Cascade Gulch, Shastina, ridge, 28 Aug 1947, W. B. Cooke 20477 (ISOTYPE).

Diadema tetramerum R. A. Shoemaker & C. E. Babcock, Canad. J. Bot. 67: 1354. 1989.

On *Trisetum spicatum*. U. S. A.: California, Siskiyou Co., Mt. Shasta, ridge S of Horse Camp, 2 Jul 1947, W. B. Cooke 20223 (ISOTYPE).

Diaporthe albocarnis Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1893: 140. 1893.

On the smaller dead limbs of *Cornus sp.* Canada: Ontario, London, May 1891, J. Dearness s.n., NAF 2820 (SYNTYPE).

≡ *Massarina albocarnis* (Ell. & Ev.) Barr ined.

Diaporthe aliena Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1893: 142. 1893.

On *Crataegus*. Canada: Ontario, London, s.d., J. Dearness s.n., NAF 3431 (Possible TYPE).

Diaporthe aorista Ell. & Ev., Bull. Torrey Bot. Club 24: 132. 1897.

On dead stems of *Solidago sp.* U. S. A.: New Jersey, Newfield, Jul 1896, NAF 3432. (ISOTYPE).

Diaporthe caryigena Ell. & Ev., J. Mycol. 9: 223. 1903.

On dead limbs of *Hicoria minima*. Canada: Ontario, London, Oct 1903, J. Dearness s.n., Fungi Col. 1919 (Possible TYPE).

Diaporthe juglandis Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1893: 448. 1894

On bark of *Juglans cinera*. U. S. A.: New York, Alcove, Aug 1893, C. L. Shear s.n., NAF 3121 (Possible ISOTYPE).

Diaporthe pruni Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1893: 141. 1893.

On dead limbs of *Prunus virginiana*. Canada: Ontario, London, Apr 1892, J. Dearness s.n., NAF 2822. (Possible SYNTYPE).

Diaporthe stereostoma Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1894: 338. 1894.

On dead branches of *Symphoricarpos occidentalis*. U. S. A.: Kansas, Rockport, 7 Jun 1894, E. Bartholomew s.n., NAF 1482 (ISOTYPE).

= *Diaporthe apiculosa* (Alb. & Schwein.: Fr.) Nits., fide Wehmeyer, The genus *Diaporthe* p.114. 1933.

Diaporthopsis metrosideri M. K. Roane & F. R. Fosberg, Mycologia 75: 165. 1983.

On bark of *Metrosideros collina*. U. S. A.: Hawaiian Islands, Hawaii, Hawaii Volcanoes National Park, Chain of Craters road, Pihumau crater, 20 Mar 1977, Fosberg 56728 (ISOTYPE).

≡ *Endothia metrosideri* (M. K. Roane & F. R. Fosberg) Barr, Mycologia 75: 930. 1983.

Diatrypella deusta Ell. & Martin, Amer. Naturalist 16: 809. 1882.

On petioles of *Sabal serrulata*. U. S. A.: Florida, Green Cove Springs, Winter 1882, Dr. Martin s.n., NAF 1184. (Two SYNTYPES).

≡ *Diatrype (Diatrypella) deusta* (Ell. & Martin) Cooke, Grevillea 14: 15. 1885.

≡ *Allescherina deusta* (Ell. & Martin) Berl. in Abbado, Malpighia 16: 303. 1902.

≡ *Cryptovalsa deutsa* (Ell. & Martin) Petrak, Sydowia 7: 103. 1953.

Diatrypella rimosa Shear, Bull. Torrey Bot. Club 29: 454. 1902.

On *Alnus sp.* U. S. A.: Oregon, Wallowa Lake, Aug 1899, Shear s.n., West American Fungi 320 (ISOTYPE).

Dictyoporthe acerophila Barr, Mycologia Memoir 7: 188. 1978.

On dead branches of fallen, but partly living *Acer saccharum*. U. S. A.: New Hampshire, White Mountains N.F., off Rt. 16, near Pinkham Notch, 29 Jul 1963, Barr 4007 (HOLOTYPE).

Didymella inaequalis Corbaz, Phytopathol. Z. 28: 399. 1957.

On *Aconitum lycoctonum*. France: St. Veran, Val Queyras, Hautes Alpes, 26 Aug 1954, Müller & Corbaz s.n. (Probable ISOTYPE).

Didymella nigra Corbaz, Phytopathol. Z. 28: 408. 1957.

On dead stems of *Astragalus glycyphyllus*. Switzerland: Alvaneubad, Kanton Graubünden, 11 Jun 1955, Müller s.n. (Probable ISOTYPE).

Didymella prominens Ell. & Ev., J. Mycol. 2: 101. 1886.

On dead herbaceous stems of *Ambrosia trifida*. U. S. A.: Louisiana, Point a la Hache, May 1886, A. B. Langlois s.n., NAF 1796 (Possible ISOTYPE).

Didymella stromatica Barr & Rogerson, Mycotaxon 17: 251. 1983.

On dead stems of *Thermopsis montana*. U. S. A.: Utah, Uintah Co., Ashley National Forest, Green's Lake, near Red Canyon of Green River, 29 May 1966, Rogerson s.n. (ISOTYPE).

Didymosphaeria manitobiensis Ell. & Ev., North Amer. Pyrenomycetes p.782. 1892.

On leaves of *Rubus sp.* Canada: Manitoba, Little Saskatchewan, Oct 1891, J. Dearness s.n. NAF 2761 (Possible ISOTYPE).

= *Hormotheca rubicola* (Ell. & Ev.) Corlett & Barr, Mycotaxon 25: 256. 1986.

Dothidea acerva Barr, Contr. Univ. Michigan Herb. 9: 611. 1972.

On dead leaves, branches, and pistillate aments of *Juniperus communis*. U. S. A.: Massachusetts, Conway, Pine Hill, 22 May 1966, Barr 4821 (HOLOTYPE).

Dothidea conspicua Griffiths, Bull. Torrey Bot. Club 26: 442. 1899.

On *Yucca angustifolia*. U. S. A.: Montana, Billings, Aug 1898, West American Fungi 43 (ISOTYPE).

See Barr, Contr. Univ. Michigan Herb. 9: 610. 1972. for complete synonymy.

Dothidotthia diapensiae Barr, Mycotaxon 34: 522. 1989.

On leaves of *Diapensia lapponica*. Canada: Northwest Territory, Baffin Island, head of Clyde Inlet, 6 Jul 1950, P. Danserau 5007062299a. (HOLOTYPE).

Dothiora slippii Barr, Contr. Univ. Michigan Herb. 9: 575. 1972.

On branches of *Pinus albicaulis*. U. S. A.: Idaho, Priest River Experimental Forest, Looking Glass Lookout, 10 Oct 1939, A. W. Slipp 584A (HOLOTYPE).

Emericella nivea Wiley & Simmons, Mycologia 65: 934. 1973.

Isolated from forest soil. Thailand: Pak Thong Chai, Apr 1967, Simmons s.n., QM 8942 (ISOTYPE).

≡ *Fennellia nivea* (Wiley & Simmons) R. A. Samson, Stud. Mycol. Baarn 18: 5. 1979.

Endocoleroa concinna Petrak, Sydowia 22 (1968): 389. 1969.

On living overwintered leaves of *Waldsteinia fragarioides*. U. S. A.: New York, Albany Co., Clarksville, 8 Apr 1945, H. D. House 37 (ISOTYPE).

≡ *Coleroa concinna* (Petrak) Barr, Sydowia 41: 31. 1989.

= *Venturia concinna* (Petrak) v. Arx & Müller, Stud. Mycol. Baarn 9: 99. 1975.

Eriosphaeria herbarum Wehmeyer, Sydowia 6: 419. 1952.

On stems of *Achillea millefolium* var. *alpicola*. U. S. A.: Washington, Pierce Co., Mt. Rainier National Park, Dege Peak Trail, 6900 ft, 19 Aug 1948, part of Simmons R1934 (ISOTYPE).

≡ *Lophiostoma herbarum* (Wehmeyer) R. A. Shoemaker & C. E. Babcock, Canad. J. Bot. 65: 389. 1987.

≡ *Herpotrichia* Barr ined.

Eutypella alpina Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1895: 425. 1895.

On dead trunks of *Alnus incana*. U. S. A.: Colorado, Larimer Co., Jul 1895, C. F. Baker s.n., NAF 3331. (Possible ISOTYPE).

≡ *Engizostoma alpinum* (Ell. & Ev.) Kuntze, Rev. Gen. Pl. 3: 473. 1898.

= *Eutypella cerviculata* (Schwein.: Fr.) Sacc., fide Rappaz, Mycologia Helvetica 2: 527. 1987.

Eutypella carpinicola Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1894: 342. 1894.

On dead trunks of *Carpinus americana*. U. S. A.: New York, Alcove, Oct 1893, C. L. Shear s.n., NAF 3028 (Possible ISOTYPE).

≡ *Engizostoma carpinicola* (Ell. & Ev.) Kuntze, Rev. Gen. Pl. 3(2): 473. 1898.
≡ *Massalongella carpinicola* (Ell. & Ev.) Berl., Icon. Pyren. 3: 1. 1900.

Exoascus aceris Dearn. & Barth., Mycologia 9: 350. 1917.
On living leaves of *Acer grandidentatum*. U. S. A.: Utah, Salt Lake Co., Parley's Canyon, 29 Jun 1915, Bartholomew & Garrett s.n., Fungi Col. 5018 (ISOTYPE).
≡ *Taphrina aceris* (Dearn. & Barth.) Mix., Univ. Kansas Sci. Bull. 24: 156. 1936. non *Taphrina aceris* Linhorst 1885.
≡ *Taphrina bartholomaei* Mix., Univ. Kansas Sci. Bull. 33: 149. 1949.

Extrawettsteinina minuta Barr, Contr. Univ. Michigan Herb. 9: 538. 1972.
On dead leaves of *Juniperus communis*. Canada: Quebec, Gaspé Prov. Park, Mt. Albert, trail to Lac Diable, 19 Aug 1957, Barr 2194 (HOLOTYPE).

Fennellia flavipes Wiley & Simmons, Mycologia 65: 937. 1973.
Isolated from cellulosic material buried in forest soil. Thailand: Pak Thong Chai, Feb 1968, C. Klinsukont s.n., QM 9131 (ISOTYPE).

Gibbera sphyrospermi Samuels, Barr & Rogerson, Brittonia 40: 393. 1988.
On fruit of *Sphyrospermum cordifolium*. Panama: Prov. Chiriquí, Guadalupe Arriba, above Cerro Punta, cloud forest, 23 Jul 1985, G. de Nevers & Charnley 6030 (ISOTYPE).

Gnomonia agrifoliae Barr, Mycotaxon 41: 292. 1991.
On *Quercus agrifolia*. U. S. A.: California, Marin Co., Mt. Tamalpais, Alpine Lake, 2 Dec 1971, Barr 5912b as *Pleuroceras lirelliformis* (HOLOTYPE).

Gnomonia caryae var. *ribis* Barr, Mycologia Memoir 7: 46. 1978.
On overwintered leaves of *Ribes cynosbati*. U. S. A.: Maine, Baxter State Park, McCarthy Field, 26 Jun 1962, Barr 3230b (HOLOTYPE).
≡ *Gnomonia ribis* (Barr.) Barr, Mycotaxon 41: 292. 1991.

Gnomonia dalibardae Barr, Mycologia Memoir 7: 62. 1978.
On overwintered leaves of *Dalibarda repens*. U. S. A.: Maine, Penobscot Co., Cedar Lake, 24 Aug 1962, Barr 3689 (HOLOTYPE).

Gnomonia intermedia var. *alni* Barr, Mycologia Memoir 7: 55. 1978.
On overwintered leaves of *Alnus rugosa* var. *americana*. U. S. A.: Maine, Baxter State Park, Basin Pond, 5 Jul 1962, Barr 3322 (HOLOTYPE).
= *Gnomonia alni-viridis* Podlahova & Svrcek, fide Monod, Beih. Sydowia 9: 89. 1983.

Gnomonia peckii Monod, Beih. Sydowia 9: 114. 1983.
On dead leaves of *Sieversia peckii*. U. S. A.: New Hampshire, Mt. Washington, Alpine Gardens, 19 Aug 1963, Barr 4095 as *Gnomonia gei-montani* (HOLOTYPE).
On the label the host name is *Geum peckii*, which is the current valid name.

Gnomonia quercus-coccineae Monod, Beih. Sydowia 9: 99. 1983.
On dead leaves of *Quercus borealis*. U. S. A.: New Hampshire, South Conway, 3 Jul 1963, Barr 3819a as *Pleuroceras lirellaeformis* (HOLOTYPE).

Gnomonia quercus-gambellii Monod, Beih. Sydowia 9: 98. 1983.
On dead leaves of *Quercus gambellii*. U. S. A.: Arizona, North Rim of Grand Canyon, 18 Aug 1973, Barr 6095 as *Gnomonia fasciculata* (HOLOTYPE).

Gnomonia ribicola Barr, Mycologia Memoir 7: 48. 1978.
On overwintered leaves of *Ribes americana*. U. S. A.: Maine, Baxter State Park, Basin Pond, 5 Jul 1962, Barr 3308 (HOLOTYPE).

Gnomonia similisetaceae Barr, Mycologia Memoir 7: 48. 1978.

On overwintered leaves of *Euonymus alata*. U. S. A.: Massachusetts, Conway, Baptist Hill, 3 Apr 1974, Barr 6199 (HOLOTYPE).

Gnomoniella destruens Barr & Hodges, Mycologia 79: 782. 1987.

On leaves and stems of *Eucalyptus globulus* seedlings. U. S. A.: Hawaiian Islands, Hawaii, Hilo, 16 Oct 1981, Hodges s.n. (ISOTYPE).

Gnomoniella fraxini S. C. Redlin & R. W. Stack, Mycotaxon 32: 185. 1988.

On *Fraxinus pennsylvanica*. U. S. A.: North Dakota, Fargo, North Dakota State University Campus; Walster Hall West, 24 May 1985, Redlin (SCR3) 85/12 (ISOTYPE).

Godronia rugosa Ell. & Ev., J. Mycol. 8: 70. 1902.

On dead limbs of *Oxydendrum arboreum*. U. S. A.: Alabama, Tuskegee, 7 Sep 1900, G. W. Carver s.n., Fungi Col. 1534 (SYNTYPE).

Grandigallia dictyospora Barr, Hanlin, Cedeño, Parra & Hernandez, Mycotaxon 29: 196. 1987.

On branches of *Polylepis sericea*. Venezuela: Mérida, Paramo de la Culata, Dec 1984, L. Cedeño, J. Parra & R. Hernandez s.n. (ISOTYPE).

Graphyllium californianum Barr, Mem. New York Bot. Gard. 62: 40. 1990.

On stalks of *Wyethia sp*. U. S. A.: California, Shasta Co., Lassen Volcanic National Park, 12 Jul 1966, W. B. & V. G. Cooke 37166. (HOLOTYPE).

Guignardia prominens Earle, Muhlenbergia 1: 15. 1900.

On living leaves of *Aigiphila martinicensis*. Porto Rico: on calcareous hills E of Santurce, 20 Feb 1900, A. A. Heller 4674 (ISOTYPE).

≡ *Laestadia prominens* (Earle) Sacc. & D. Sacc., Sylloge Fungorum 17: 575. 1905.

Helotiella papyricola Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1894: 351. 1894.

On old pasteboard lying by the roadside. U. S. A.: New Jersey, Newfield, 6 Aug 1894, Ellis s.n. (Possible SYNTYPE).

Herpotrichiella polyspora Barr, Contr. Inst. Bot. Univ. Montréal 73: 29. 1959.

On dead leaves of *Cassiope tetragona*. Canada: Newfoundland, Labrador, Hebron, 22 Oct 1955, R. T. Wilce 404 (ISOTYPE).

≡ *Polytrichiella polyspora* (Barr) Barr, Contr. Univ. Michigan Herb. 9: 617. 1972.

≡ *Capronia polyspora* (Barr) Müller et al. Trans. Brit. Mycol. Soc. 88: 73. 1987.

Hypocrea avellanea Rogerson & S. T. Carey, Brittonia 28: 381. 1977.

On deformed basidiocarps of *Marasmius subnudus*. U. S. A.: Massachusetts, Leverett, Mt. Toby State Forest, 27 Aug 1958, Barr 2471 (ISOTYPE).

Hypocrea ochroleuca Berk. & Rav., Grevillea 4: 14. 1875.

No host specified. U. S. A.: South Carolina, s.d., Ravenel 1382 (ISOTYPE).

Collection labelled as *Sphaeria ochroleuca* B. & Rav.

Hypocrea tenerrima Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1893: 442. 1894.

Spreading over mosses and decaying sticks etc. U. S. A.: New Jersey, Newfield, Jul 1893, L. W. Nuttall s.n., NAF 3009 (Possible ISOTYPE).

Hyponectria betulina Barr, Mycologia 69: 960. 1977.

On overwintered leaves attached to felled tree of *Betula sp*. U. S. A.: Maine, Baxter State Park, Katahdin Stream, 10 Jul 1962, Barr 3358a (HOLOTYPE).

Hypoxylon bartholomaei Peck, Ann. Rep. New York State Mus. 64: 56. 1910.

On dead saplings of *Alnus rubra*. U. S. A.: Washington, Kitsap Co., Bainbridge Island, 26 Aug 1909, E. Bartholomew s.n., Fungi Col. 3332 (ISOTYPE).

Hypoxylon occidentale Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1894: 345. 1894, non *Hypoxylon occidentale* Ell. & Morg. ex Martin, J. S. African Bot. 42: 82. 1976.

On dead limbs of deciduous trees. U. S. A.: California, Pasadena, Mar 1894, A. J. McClatchie s.n., NAF 3127 (Possible ISOTYPE).

= *Hypoxylon thouarsianum* (Lév.) Lloyd, Mycological Writings 5: 26. 1919.

Hysterium nova-caesariense Ell., Bull. Torrey Bot. Club 6: 133. 1877.

On *Pinus rigida*. U. S. A.: New Jersey, Newfield, s.d., Ellis NAF 152 (Possible SYNTYPE).

≡ *Ostreichnion nova-caesariense* (Ell.) Barr, Mycotaxon 3: 84. 1975. See there for complete synonymy.

There is a specimen of *Hysterium nova-caesariense* Ell. at NY annotated as lectotype: "In pine bark, Newfield, N. J., W. R. Gerard 5." The lectotypification was proposed by M. L. Lohman on 2 Nov 1953, but to our knowledge it was never published.

Hysterographium opuntiae J. G. Brown, Mycologia 45: 967. 1953.

On *Opuntia fulgida*. U. S. A.: Arizona, Pima Co., Saguarro National Monument, East Unit, 9 Apr 1974, R. L. Gilbertson 11196 (NEOTYPE).

≡ *Rhytidhysteron opuntiae* (J. G. Brown) Barr, Mem. New York Bot. Gard. 62: 72. 1990.

Hysteropatella oregana Sherwood-Pike & Barr, Sydowia 38: 275. 1986.

On decorticated branches of *Artemisia sp.* U. S. A.: Oregon, Lake Co., Picture Rock Pass, 7 Jun 1984, Sherwood-Pike s.n. (ISOTYPE).

Keissleriella abruptipapilla Barr, North American Flora II, 13: 10. 1990.

On rachis of *Yucca glauca*. U. S. A.: Oklahoma, Payne Co., Ripley Bluffs, 1 mi N of Ripley, 16 Aug 1979, Barr 6700 (HOLOTYPE).

Leiosphaerella falcata Barr, Rhodora 68: 186. 1966.

On small dead branches of *Acer pensylvanicum*. U. S. A.: Maine, Baxter State Park, Katahdin Stream Campground, 23 Jul 1962, Barr 3460 (HOLOTYPE).

Lembosia agaves Earle, Muhlenbergia 1: 15. 1901.

On living leaves of *Agave sp.* Porto Rico: dry slopes W of Cabo Rojo, 29 Jan 1900, A. A. Heller 4429 (ISOTYPE).

Lembosia coccolobae Earle, Bull. New York Bot. Gard. 3: 301. 1905.

On upper surface of *Coccoloba uvifera (as Coccolobis uvifera)*. Porto Rico: Santurce, San Antonio Station, in clay and sand, 7 Jan 1903, A. A. Heller 6375 (ISOTYPE).

Leptosphaeria ellisiana Berl., Icon. Pyren. 1: 68. 1892.

On dead stems of *Oenothera biennis*. U. S. A.: New Jersey, Newfield, May s.d., Ellis NAF 697 as *Sphaeria (Lept.) subconica* (ISOTYPE).

Leptosphaeria hispanica J. Checa & G. Moreno, Canad. J. Bot. 65: 2096. 1987.

On twigs of *Artemisia vulgaris*. Spain: Madrid, Aranjuez, 3 Feb 1985, P. Yebes & J. Checa 3915 (ISOTYPE).

Leptosphaeria microspora Ell. & Ev., Bull. Torrey Bot. Club 24: 461. 1897.

On dead stems of *Lespedeza capitata*. Canada: Ontario, London, Aug 1897, J. Dearness s.n. Ell. & Ev. NAF 3524 (Probable ISOTYPE).

≡ *Paraphaeosphaeria microspora* (Ell. & Ev.) Shoemaker & Babcock, Canad. J. Bot. 63: 1286. 1985.

Leptosphaeria sambucina Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1894: 336. 1894.

On dead *Sambucus melanocarpa*. U. S. A.: Colorado, Cameron Pass, 24 Jul 1894, C. F. Baker s.n., ex herb. Ellis (Probable ISOTYPE).

≡ *Chaetomastia sambucina* (Ell. & Ev.) Barr, Mycotaxon 34: 513. 1989.

Lewia eureka Simmons, Mycotaxon 25: 304. 1986.

From seed of *Medicago rugosa* cv. *Paragosa (36-103)*. Australia: Reisolated conidia, 1985, by E. G. S. ex cult. IMI 273162, s.d., Simmons s.n. (ISOTYPE).

≡ *Allewia eureka* (Simmons) Simmons, Mycotaxon 38: 264. 1990.

Limacinia moniliforma var. *quinqueseptata* Barr, Canad. J. Bot. 33: 507. 1955.

On twigs of *Pseudotsuga taxifolia*. Canada: British Columbia, Lake Cowichan, V. I., 10 Sep 1943, Foster DAVFP 8332 (ISOTYPE).

≡ *Metacapnodium quinqueseptatum* (Barr) Hughes, New Zealand J. Bot. 10: 233. 1972.

Linocarpon umbelliferarum Barr, Canad. J. Bot. 39: 320. 1961.

On overwintered stalks of *Heracleum lanatum*. Canada: Quebec, Mt. Albert, Lac Diable, 19 Aug 1957, Barr 2198a (HOLOTYPE).

≡ *Plagiosphaera umbelliferarum* (Barr) Barr, Mycologia Memoir 7: 123. 1978.

Linospora brunellae Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1894: 337. 1894.

On living leaves of *Brunella vulgaris*. U. S. A.: Washington, W. Klikitat Co., Columbia River, Apr 1886, W. N. Suksdorf s.n., NAF 3120 (ISOTYPE).

≡ *Leptosphaeria hesperia* Barr, Nom. nov. for *L. brunellae* Ell. & Ev., Canad. J. Bot. 45: 1044. 1967. See there for synonymy.

≡ *Ophiobolus prunellae* (Ell. & Ev.) Shoemaker, Canad. J. Bot. 54: 2388. 1976. See there for note on the change of the epithet spelling.

Lophiostoma radicans Ell. & Ev., J. Mycol. 3: 44. 1887.

On decorticated, decaying stems of *Toxicodendron radicans*. U. S. A.: New Jersey, Newfield, Jul 1878, NAF 1795 (ISOTYPE).

This collection was annotated by Barr as *Lophiostoma macrostomum* (Tode: Fr.) Ces. & de Not.

Melanomma parasiticum Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1890: 240. 1890.

On old *Diatrype stigma*. U. S. A.: New Jersey, Newfield, Apr 1889, Ellis s.n., NAF 2367 (ISOTYPE).

≡ *Herpotrichiella parasitica* (Ell. & Ev.) Barr, Contr. Univ. Michigan Herb. 9: 615. 1972.

≡ *Capronia parasitica* (Ell. & Ev.) Müller et al., Trans. Brit. Mycol. Soc. 88: 67. 1987.

Melanomma spiniferum Ell. & Ev., North Amer. Pyrenomycetes p.184. 1892.

Growing round the base of a living white oak on some *Corticium?*. U. S. A.: Delaware, Wilmington, Sep 1890, A. Commons s.n., NAF 2610 (ISOTYPE).

≡ *Herpotrichiella spinifera* (Ell. & Ev.) Barr, Rhodora 65: 300. 1963.

≡ *Capronia spinifera* (Ell. Ev.) Müller et al., Trans. Brit. Mycol. Soc. 88: 69. 1987.

In the description, the host is given as "..growing on the base of trunks of *Morus rubra*."

Meliola andirae Earle, Bull. New York Bot. Gard. 3: 303. 1905.

On leaves of *Andira inermis*. Porto Rico: Sancturce, in sand, 22 Jan 1903, A. A. Heller 6448 (ISOTYPE).

Meliola chamaecristae Earle, Bull. New York Bot. Gard. 3: 304. 1905.

On leaves and stems of *Chamaecrista glandulosa*. Porto Rico: Sancturce, San Antonio Station, in clay and sand, 7 Jan 1903, A. A. Heller 6371 (ISOTYPE).

Meliola circinans Earle, Bull. New York Bot. Gard. 3: 304. 1905.

On leaves of *Rhynchospora aurea*. Porto Rico: calcareous hills E of Santurce, 8 Jan 1903, A. A. Heller 6384 (ISOTYPE).

Meliola cryptocarpa Ell. & Martin, Amer. Naturalist 17: 1284. 1883.

On leaves of *Gordonia lasianthus*. U. S. A.: Florida, Green Cove Springs, Jan 1883, Martin s.n., NAF 1293 (Two SYNTYPES).

≡ *Irenina cryptocarpa* (Ell. & Martin) Hansford, Proc. Linn. Soc. London 157: 171. 1946.

≡ *Irenopsis cryptocarpa* (Ell. & Martin) Hansford, Beih. Sydowia 2: 127. 1961.

This collection was annotated by Barr as *Hyalomeliolina meliolicola*. This species is parasitic on *Meliola* (M. Barr, pers. comm.).

Meliola helleri Earle, Bull. New York Bot. Gard. 3: 307. 1905.

On leaves of unknown Myrtaceae. Porto Rico: 3 mi W of Ponce, limestone hills along the coast, 9 Dec 1902, A. A. Heller 6251 (ISOTYPE).

Meliola ipomoeae Earle, Muhlenbergia 1: 11. 1901.

On living leaves of *Ipomoea sp.* Porto Rico: 2 mi NE of Mayaguez, 23 Jan 1900, A. A. Heller 4358 (ISOTYPE).

= *Meliola malacotricha* Speg., fide Hansford, Beih. Sydowia 2: 647. 1961.

Meliola mangifera Earle, Bull. New York Bot. Gard. 3: 307. 1905.

On leaves of *Mangifera indica*. Porto Rico: E of Rio Piedras, 9 Jan 1903, A. A. Heller 6393 (SYNTYPE).

Meliola panici Earle, Muhlenbergia 1: 12. 1901.

On *Panicum latifolium*. Porto Rico: on calcareous hills E of Santurce, 19 Jan 1900, A. A. Heller 4343 (ISOTYPE).

Meliola piperis Earle, Muhlenbergia 1: 12. 1901.

On twigs of *Piper aduncum*. Porto Rico: in damp woods S of Mayaguez, 23 Jan 1900, A. A. Heller 4359b (ISOTYPE).

Meliola psychotriae Earle, Bull. New York Bot. Gard. 3: 308. 1905.

On *Erithalis fruticosa*. Porto Rico: near the sea at Santurce in sand, 19 Jan 1903, A. A. Heller 6430 (SYNTYPE).

On leaves of *Psychotria sp.* Porto Rico: limestone hills along the coast 3 mi W of Ponce, 9 Dec 1902, A. A. Heller 6252 (SYNTYPE).

Meliola thouiniae Earle, Bull. New York Bot. Gard. 3: 308. 1905.

On leaves of *Thouinia striata*. Porto Rico: limestone hills near Bayamon, 21 Jan 1903, A. A. Heller 6435 (ISOTYPE).

Metasphaeria carveri Ell. & Ev., J. Mycol. 8: 68. 1902.

On dead stems of *Sesamum orientale*. U. S. A.: Alabama, Tuskegee, 2 Dec 1900, G. W. Carver s.n., Fungi Col. 1627 (SYNTYPE).

= *Glomerella cingulata* (Stoneman) Spould & v. Schrenk, M. E. Barr, pers. comm.

Metasphaeria maximiliani Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 45: 136. 1893.

On *Helianthus maximiliani*. U. S. A.: Kansas, Rockport, Dec 1892, Bartholomew 821 as NAF 2926 (ISOTYPE).

≡ *Paraphaeosphaeria maximiliani* (Ell. & Ev.) Barr, Mycotaxon: in press.

Micropeltis longispora Earle, Bull. New York Bot. Gard. 3: 311. 1905.

On living leaves of coffee plant. Porto Rico: on the Adjuntas road 10 mi from Ponce, 27 Dec 1902, A. A. Heller s.n. (Probable ISOTYPE).

≡ *Scolecopeltis longispora* (Earle) Toro, Mycologia 17: 136. 1925.

≡ *Scolecopeltella longispora* (Earle) Batista, Inst. Micol. Univ. Recife 56: 303. 1959.

≡ *Chaetothyrium longispora* (Earle) Barr ined.

Monascostroma pruni Barr, Contr. Univ. Michigan Herb. 9: 540. 1972.

On dead branches of *Prunus pennsylvanica*. U. S. A.: New Hampshire, near Gorham, Stony Brook Trail, 16 Jul 1963, Barr 3996 (HOLOTYPE).

Mycosphaerella juglandis Kessler, Mycologia 76: 363. 1984.

On foliage of *Juglans nigra*. U. S. A.: Illinois, Alexander Co., Tamms, SW1/2 Sec.

28, T14S R2W, 23 May 1979, K. J. Kessler, Jr. s.n., BPI 72497 (Probable ISOTYPE).

Even though the BPI number is not given on the specimen in the MASS Herbarium, our specimen is most likely the ISOTYPE, because the specimen labels of the BPI specimen and our specimen are identical.

Mycosphaerella linnaeae Barr, Rhodora 68: 187. 1966.

On overwintered leaves of *Linnaea borealis* var. *americana*. U. S. A.: New Hampshire, White Mountains N.F., Jefferson, Millbrook Trail, 6 Jul 1963, Barr 3831 (HOLOTYPE).

Myriococcum everhartii Sacc. & Ell., Sylloge Fungorum 1: 760. 1882.

Inside a rotten log of *Nyssa*. U. S. A.: New Jersey, Newfield, Oct 1880, Ellis & Harkness s.n., NAF 766 (Two ISOTYPES).

Myrmaecium cannae Dearn. & Barth., Mycologia 9: 347. 1917.

On withered leaves of *Canna indica*. Porto Rico: Cabo Rojo, 30 Oct 1912, F. L. Stevens s.n., Fungi Col. 5038. (ISOTYPE).

= *Eudarluca cannae* (Fr.) O. Eriksson. Bot. Not. 119: 33. 1966.

Mytilinidion juniperi Ell. & Ev., J. Mycol. 4: 57. 1888.

On outer bark of living *Juniperus virginiana*. U. S. A.: New Jersey, Newfield, Apr 1888, NAF 2152 (Possible ISOTYPE).

= *Mytilinidion tortile* (Schwein.:Fr.) Sacc. fide Barr, North Amer. Flora II, 13: 93. 1990.

Nectria lasioderma Ell., Amer. Naturalist 17: 194. 1883.

On dead limbs of Quercus coccinea lying on the ground, parasitic on old *Valsa lutescens* Ell. U. S. A.: New Jersey, Newfield, Jun 1882, NAF 1177 (ISOTYPE).

≡ *Lasionectria lasioderma* (Ell.) Cooke, Grevillea 12: 112. 1884.

≡ *Cucurbitaria lasioderma* (Ell.) Kuntze, Rev. Gen. Pl. 3(2): 461. 1898.

≡ *Nectriopsis lasioderma* (Ell.) Samuels, Mem. New York. Bot. Gard. 48:31. 1988.

Neotestudina diplodioides Barr, Mycotaxon 29: 505. 1987.

On branches of *Artemisia sp.* U. S. A.: Utah, Millard Co., Lynndyl, 1 Jun 1955, K. McKnight s.n. (HOLOTYPE).

Ohleriella nudilignae Barr & Malloch, North American Flora II, 13: 61. 1990.

On dead stems of *Opuntia fulgida*. U. S. A.: Arizona, Pima Co., Saguarro National Monument, West Unit, 29 Jul 1980, R. L. Gilbertson s.n., deposited in MASS as Barr 6765. (HOLOTYPE).

Parodiella fruticola Ell. & Ev., J. Mycol. 4: 97. 1888.

On dead stems of *Clematis ligustifolia*. U. S. A.: Montana, Sand Coulee, Feb 1888, F. W. Anderson s.n., NAF 2129 (Possible ISOTYPE).

≡ *Dothidotthia fruticola* (Ell. & Ev.) Barr, Mycotaxon 34: 522. 1989. See there for complete synonymy.

Pestalosphaeria concentrica Barr, Mycologia 67: 188. 1975.

On living leaves of *Rhododendron maximum*. U. S. A.: Virginia, Floyd Co., Blue Ridge Parkway, 14 Nov 1971, Bigelow & C. & M. Roane s.n. (HOLOTYPE).

Phomatospora gelatinospora Barr, Mycologia 62: 385. 1970.

On dead reddish brown leaves of *Rhododendron maximum*. U. S. A.: New Hampshire, Fitzwilliam, Rhododendron State Park, 25 Jun 1968, Barr 5153 (HOLOTYPE).

Phyllachora leea-elatae A. K. Kar & M. K. Maity, Mycologia 63: 1024. 1971.

On leaves of *Leea elata*. India: West Bengal, Jalpaiguri, Rajabhatkhawa forest, 28 Oct 1967, Maity s.n., PCC 1487 (ISOTYPE).

Phyllachora oryzopsidis Theissen & Sydow, Ann. Mycol. 13: 451. 1915.

On leaves of *Oryzopsis asperifolia*. Canada: Ontario, London, Aug 1910, J. Dearness s.n., Fungi Col. 3536 (SYNTYPE).

Distributed in Fungi Columbiani as *Phyllachora graminis* var. *oryzopsidis*.

Physalospora aurantia Ell. & Ev., North Amer. Pyrenomycetes p.304. 1892.

On leaves of *Astragalus pectinatus*. U. S. A.: Montana, Sand Coulee, Aug 1888, F. W. Anderson s.n., NAF 2355 (ISOTYPE).

= *Polystigma astragali* (Lasch) v. Höhnel, fide v. Arx & Müller, Beitr. Kryptogamenfl. Schweiz 11: 234-235. 1954.

Physalospora rhododendri var. *albimontana* Barr, Mycologia 62: 390. 1970.

On dead leaves of *Rhododendron lapponicum*. U. S. A.: New Hamsphire, Mt. Washington, Alpine Gardens, 9 Jul 1963, Barr 3859a (HOLOTYPE).

Plagiostoma jensenii Barr, Mycotaxon 41: 298. 1991.

In leaves of *Alnus rubra* (*A. oregona* on label). Canada: British Columbia, Duncan, 17 Jun 1971, Barr 5775 as *Plagiostoma alnea* (HOLOTYPE).

Plagiostoma solidaginis J. C. Cooke & Barr, Mycotaxon 18: 87. 1983.

On overwintered stems of *Solidago sempervirens*. U. S. A.: Connecticut, Westbrook, Westbrook marsh, E of Patchaug River, N of Rt. 1, 18 Jul 1979, J. C. Cooke M-46, N. Capozzi & M. Cooke (HOLOTYPE).

Pleomassaria hesperia Barr, Mem. New York Bot. Gard. 62: 15. 1990.

On decorticated wood of *Populus tremuloides*. U. S. A.: Colorado, Larimer Co., Roosevelt National Forest, 3 mi W of Redfeather Lakes, 4 Aug 1984, Barr 7000 (HOLOTYPE).

Pleospora alismatis Ell. & Ev., J. Mycol. 8: 16. 1902.

On *Alisma plantago*. U. S. A.: South Dakota, Tecoma Park, Feb 1898, West American Fungi 308 (Possible ISOTYPE).

= *Karstenula rubelloides* (Plowright ex Cooke) Barr, North American Flora II, 13: 51. 1991. See there for complete synonymy.

Pleospora hysterioides Ell. & Ev., Erythea 2: 19. 1894.

On dead culms of *Sporobolus asper*. U. S. A.: Kansas, Rockport, Mar 1893, E. Bartholomew s.n., NAF 3020 (Probable SYNTYPE).

≡ *Graphyllium hysterioides* (Ell. & Ev.) Barr, Mycotaxon 29: 504. 1987. See Barr, Mem. New York Bot. Gard. 62: 42. 1991. for complete synonymy.

Pleospora magnifica Peck, Bull. Torrey Bot. Club 33: 221. 1906.

On dead stems of *Phlox sp*. U. S. A.: Utah, Silver Lake, 17 Aug 1905, A. O. Garrett s.n., Fungi Col. 2258 (ISOTYPE).

Pleuroceras labradorense Monod, Beih. Sydowia 9: 168. 1983.

On dead leaves of *Salix reticulata*. Canada: Newfoundland, Labrador, Hebron vicinity, 24 Jul 1954, R. T. Wilce 141 as *Pleuroceras pleurostyla* (HOLOTYPE).

Pleuroceras oregonense Monod, Beih. Sydowia 9: 164. 1983.

On dead leaves of *Salix sp*. U. S. A.: Oregon, Willamette National Forest, US 20 near Lost Prairie and Lava beds, 16 Aug 1975, Barr 6284 as *Pleuroceras pleurostyla* (HOLOTYPE).

Plowrightia symphoricarpi Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1890: 249. 1890.

On dead *Symphoricarpus occidentalis*. U. S. A.: Montana, Cascade Co., Great Falls, s.d., F. W. Anderson s.n., NAF 2374 (Possible ISOTYPE).

≡ *Otthia symphoricarpi* (Ell. & Ev.) Ell. & Ev., North Amer. Pyrenomycetes p.249. 1892.

= *Dothidotthia aspera* (Ell. & Ev.) Barr, Mycotaxon 34: 519. 1989. See there for complete synonymy.

Polystigma adenostomatis Farlow, Sylloge Fungorum 12: 448. 1913.

On living leaves of *Adenostoma fasciculatum*. U. S. A.: California, San Mateo Co., 12 Apr 1903, C. H. Thompson s.n., Fungi Col. 2049 (SYNTYPE).

Polytrichiella albimontana Barr, Contr. Univ. Michigan Herb. 9: 617. 1972.

On overwintered flower heads of *Geum peckii*. U. S. A.: New Hamphshire, Lake of the Clouds, Mt. Washington, 23 Jul 1963, Barr 3965 (HOLOTYPE).

≡ *Capronia albimontana* (Barr) Müller et al., Trans. Brit. Mycol. Soc. 88: 73. 1987.

Poronia leporina Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1890: 229. 1890.

On rabbit dung. U. S. A.: Montana, Emma, Sep 1889, Rev. C. H. Demetrio s.n., NAF 2354 (Possible ISOTYPE).

Protoventuria angustispora Barr, Sydowia 41: 35. 1989.

On *Rhododendron albiflorum*. Canada: British Columbia, Garibaldi Province Park, Garibaldi Lake, trail near cabin, 4 Aug 1952, Barr 630. (HOLOTYPE).

Protoventuria arizonica Barr, Sydowia 41: 35. 1989.

On dead leaves of *Cercocarpus ledifolius*. U. S. A.: Arizona, North Rim of Grand Canyon, 18 Aug 1973, Barr 6096a (HOLOTYPE).

Pseudomassaria carolinensis Barr & Hodges, Mycologia 63: 562. 1971.

Associated with *Phyllachora perseae* on living leaves of *Persea borbonia*. U. S. A.: South Carolina, near Aiken, 31 Aug 1969, C. S. Hodges s.n. (HOLOTYPE).

Pseudomassaria erumpens Barr, Mycologia 56: 853. 1964. 1965.

On dead leaves of *Kalmia polifolia*. U. S. A.: New Hampshire, Lake of the Clouds, Mt. Washington, 23 Jul 1963, Barr 3975 (HOLOTYPE).

Pseudomassaria foliicola Barr, Canad. J. Bot. 39: 318. 1961.

On overwintered leaves of *Cornus canadensis*. Canada: Quebec, Gaspé Prov. Park, Mt. Albert, woods near Chalet, 6 Jul 1957, Barr 1905 (HOLOTYPE).

Pseudomassaria inversa Barr, Rhodora 71: 200. 1969.

On dead fallen leaves of *Rhododendron lapponicum*. U. S. A.: New Hampshire, Mt. Washington, Alpine Gardens, 19 Aug 1963, Barr 4104a (HOLOTYPE).

Pseudomassaria leucothoës var. *borealis* Barr, Mycologia 56: 858. 1965.

On dead branches of *Vaccinium vitis-idaea*. Canada: Quebec, Gaspé Prov. Park, Mt. Albert, trail near chalet, 7 Jul 1957, Barr 1932F (HOLOTYPE).

Pseudomassaria leucothoës var. *gaultheriae* Barr, Mycologia 56: 859. 1964. 1965.

On dead leaves and stalks of *Gaultheria procumbens*. U. S. A.: Massachusetts, Pittsfield State Forest, 26 Jul 1961, Barr 3052 (HOLOTYPE).

Pseudomassaria occidentalis Barr, Mycologia 56: 849. 1965.

On dead leaves and stalks of *Leptarrhena pyrolifolia*. Canada: British Columbia, Garibaldi Prov. Park, ridge N of Mimulus Lake, 2 Aug 1952, Barr 612 (HOLOTYPE).

Pseudomeliola collapsa Earle, Bull. New York Bot. Gard. 3: 309. 1905. (as *Pseudomeliola(?) collapsa*).

On leaves of *Piper peltatum*, parasitic on the mycelium of *Meliola torulosa*. Porto Rico: along railroad near Pueble Viejo, 13 Jan 1903, A. A. Heller 6400 (ISOTYPE).

= *Trichothyrium reptans* (Berk. & Curt.) Hughes, fide Hughes, Mycol. Pap. 50: 85-86. 1953.

Pseudotrichia mamillata Barr, Mycotaxon 20: 22. 1984.

On unidentified bamboo. Venezuela: Miranda, Parque Nacional El Avila, S facing slope of La Silla, vicinity of refugio "No Te Apures", 30 Jun 1972, Dumont-VE 3829 (ISOTYPE).

Scirrhia crustosa Barr, Contr. Univ. Michigan Herb. 9: 567. 1972.

On dead branches of *Spirea lucida*. U. S. A.: Idaho, Bonner Co., 10-12 chains N of junction between Highway and Trail 246, 8 Jun 1940, A. W. Slipp 679 (HOLOTYPE).

Serenomyces californicus Barr, H. D. Ohr & M. K. Murphy, Mycologia 81: 50. 1989.

On *Washingtonia filifera*. U. S. A.: California, Riverside, Campus, Mar 1987, H. D. Ohr s.n. (ISOTYPE).

Sphaerella magnoliae Ell. & Ev., Bull. Torrey Bot. Club 9: 74. 1882.

On fallen leaves of *Magnolia glauca*. U. S. A.: New Jersey, Newfield, s.d., NAF 800 (ISOTYPE).

≡ *Mycosphaerella magnoliae* (Ell.) Petrak, Sydowia 5: 247. 1951.

= *Hyponectria magnoliae* (Schwein.) Barr, Mycologia 69: 963. 1977.

The specimen also bears *Mycosphaerella glauca* Cooke.

Sphaerella oenothera Ell. & Ev., J. Mycol. 1: 151. 1885.

On dead stems and capsules of *Oenothera biennis*. U. S. A.: New Jersey, Newfield, Jul 1885, NAF 1681 (ISOTYPE).

≡ *Mycosphaerella oenothera* (Ell. & Ev.) Lindau in: Engler & Prantl. Natürl. Pflanzenfam. 1: 424. 1897.

= *Mycosphaerella granulata* (Ell. & Ev.) Lindau, fide Barr, Contr. Univ. Michigan Herb. 9: 591. 1972.

Sphaeria tumefaciens Ell. & Harkness, J. Mycol. 2: 41. 1886.

On dead branches and stems of *Artemisia californica*. U. S. A.: California, Mt. Diabolo, s.d., H. W. Harkness s.n., NAF 1667 (ISOTYPE).

≡ *Syncarpella tumefaciens* (Ell. & Harkness) Theissen & Sydow, Ann. Mycol. 13: 631. 1915.

Sphaeria (Melanomma) sulcata Ell., Bull. Torrey Bot. Club 10: 53. 1883.

On bark of dead sage brush. U. S. A.: Utah, Pleasant Valley, s.d., S. J. Harkness s.n., NAF 1663 (Possible ISOTYPE).

≡ *Melanomma sulcatum* (Ell.) Ell. & Ev., North Amer. Pyrenomycetes p.183. 1892.

≡ *Syncarpella sulcata* (Ell.) Barr & Boise, Mem. New York Bot. Gard. 49: 303. 1989. See there for complete synonymy.

The original publication of the species description does not designate a type specimen. In the publication of the new combination '*Melanomma sulcatum*' (Ell.) Ell. & Ev., NAF 1633 is mentioned as type collection of this species.

Splanchnonema clandestinum Barr, Mycotaxon 15: 362. 1982.

On a twig of *Magnolia acuminata*. U. S. A.: Pennsylvania, West Chester, Jun 1883, Ellis NAF 1176 (*Stegonosporium formosum*) (HOLOTYPE).

Second species on Ellis NAF 1176.

Sporomiella oblongiclavata Barr & Malloch, North American Flora II, 13: 46. 1990.

On weathered woods of *Cercidium microphyllum*. U. S. A.: Arizona, Saguarro National Monument, West Unit, 29 Jul 1980, R. L. Gilbertson s.n., deposited in MASS as Barr 6772. (HOLOTYPE).

Stigmochora variegata Barr & Hodges, Mycologia 79: 785. 1987.

On leaves of *Pisonia sandwicensis*. U. S. A.: Hawaiian Islands, Kauai, Lapa Loop Road, 21 Aug 1985, C. S. Hodges s.n. (ISOTYPE).

Teichospora bartholomewii Barr, Mem. New York Bot. Gard. 62: 30. 1990.

On bark of *Quercus macrocarpa*. U. S. A.: Kansas, Rooks Co., Stockton, 4 Nov 1912, Bartholomew s.n., Fungi Col. 4989 as *Teichospora obducens* (ISOTYPE).

Telimenella phacidioidea Barr, Mycologia 69: 956. 1977.

On overwintered stalks of *Smilacina racemosa*. U. S. A.: Massachusetts, Conway, Baptist Hill, 28 Apr 1974, Barr 6200 (HOLOTYPE).

Valseutypella multicollis J. Checa, G. Moreno & Barr, Mycotaxon 25: 524. 1986.

On dead branches of *Quercus ilex* subsp. *rotundifolia*. Spain: Segovia, between La Granja and Riofrio, 10 Jun 1984, J. Checa & G. Moreno 3854 (ISOTYPE).

Venturia alaskensis Barr, Canad. J. Bot. 46: 821. 1968.

On *Geum sericeum*. U. S. A.: Alaska, Porcupine Dome, about 12 mi from Miller House, 12 Jul 1937, E. Scamman 802 (HOLOTYPE).

Venturia asperata Samuels & Sivanesan, New Zealand J. Bot. 13: 646. 1975.

On fallen, overwintered leaves of *Malus sylvestris* cv. *'Dougherty'*. New Zealand: Auckland Province, Waitemut Co., Oratia, DD (Plant Diseases Division DSIR) Research Orchard, Aug 1973, Brook, Samuels (73-188) & Manning, PDD 32263 (ISOTYPE).

Venturia canadensis Barr, Canad. J. Bot. 46: 818. 1968.

On overwintered leaves and stalks of *Rumex acetosella*. Canada: Quebec, Gaspé Prov. Park, Mt. Albert, trail E of chalet, 10 Jul 1957, Barr 2004 (HOLOTYPE).

Venturia cupulata Ell. & Martin, Amer. Naturalist 18: 69. 1884.

On living leaves of *Quercus laurifolia*. U. S. A.: Florida, Green Cove Springs, Mar 1884, G. Martin s.n., NAF 1298 (Possible ISOTYPE).

≡ *Johansonia cupulata* (Ell. & Martin) Barr, Mycotaxon 29: 501. 1987.

Venturia fagi Barr, Canad. J. Bot. 46: 816. 1968.

On overwintered leaves of *Fagus grandifolia*. U. S. A.: Maine, near Baxter State Park, Abol Field, 18 Jul 1962, Barr 3418A (HOLOTYPE).

Venturia iridicola Barr, Sydowia 41: 27. 1989.

On dead leaves of *Iris sp.* Canada: Newfoundland, Blanc Sablon, 19 Jul 1957, R. Wilce 158 (HOLOTYPE).

Venturia pruni Barr, Canad. J. Bot. 46: 816. 1968.

On overwintered leaves of *Prunus pensylvanica*. Canada: Quebec, Gaspé Prov. Park, Mont Albert, woods near Chalet, 6 Jul 1957, Barr 1899 (HOLOTYPE).

Wettsteinina operculata Barr, Contr. Univ. Michigan Herb. 9: 547. 1972.

On overwintered leaves and culms of *Triglochin maritima*. Canada: Newfoundland, Seal Cove Point, 11 Jul 1957, R. T. Wilce 117 (s.n. in publ.) (HOLOTYPE).

≡ *Plowrightia* Barr ined.

Wettsteinina yuccaegena Barr, Contr. Univ. Michigan Herb. 9: 547. 1972.

On dead leaves of *Yucca angustifolia*. U. S. A.: Kansas, Manhattan, Sep 1884, second species on W. A. Kellerman s.n., NAF 1366 (HOLOTYPE).

≡ *Plowrightia* Barr ined.

Xenomeris abietis Barr, Canad. J. Bot. 46: 842. 1968.

On leaf scars and twigs of *Abies grandis*. U. S. A.: Idaho, Bonner Co., Priest River Experimental Forest, Ida Creek Spur road, 5 Oct 1939, A. W. Slipp 547B (HOLOTYPE).

≡ *Plowrightia abietis* (Barr) Barr, Sydowia 41: 32. 1989.

Xenomeris saccifolii Samuels, Barr & Rogerson, Brittonia 40: 392. 1988.

On leaves of *Saccifolium bandeirae*. Brazil: Amazonas, Rio Negro, Serra da Neblina, Pico Phelps, 2 Dec 1965, B. Maguire, J. Murca Pires & C. Maguire s.n. (ISOTYPE).

Uredinales

Aecidium wedeliae Earle, Muhlenbergia 1: 16. 1900.

On living leaves of *Wedelia carnosa*. Porto Rico: along the railroad N of Mayaguez, 12 Feb 1900, A. A. Heller 4580. (ISOTYPE).

= *Endophyllum decoloratum* (Schwein.) Whetzel in Stevenson. Contr. Reed Herb. 33: 265. 1975.

Puccinia corylopsidis Cummins, Mycologia 43: 83. 1951.

On *Corylopsis sp.* China: Kwangsi, Lao Shan, Ling Yuin Hsien, 30 Apr 1933, S. Y. Cheo 1993 (ISOTYPE).

Puccinia helianthellae Arthur, Bull. Torrey Bot. Club 31: 4. 1904.

On *Helianthella nevadensis*. U. S. A.: California, Nevada Co., near Castle Peak, 31 Jul 1903, A. A. Heller 7072 (ISOTYPE).

Puccinia kweichowana Cummins, Mycologia 43: 83. 1951.

On *Polygonum campanulatum* var. *likiangensis*. China: Kweichow, Fan Ching Shan, Chiang K'ou Hsien, 3 Oct 1931, S. Y. Cheo 651 (ISOTYPE).

Puccinia moliniicola Cummins, Mycologia 43: 83. 1951.

On *Molinia sp.* China: Anhwei, Chiu Hua Shan, Ch'ing Yang Hsien, 6 Nov 1932, S. Y. Cheo 1484 (ISOTYPE).

= *Puccinia diplachnicola* Diet. in Cummins, The rust fungi of cereals, grasses and bamboos, p. 348. 1971.

Puccinia oahuensis Ell. & Ev., Bull. Torrey Bot. Club 22: 435. 1895.

On leaves of *Panicum pruriens*. Hawaiian Islands: Oahu, in and on the slopes of Makiki, 5 Apr 1895, A. A. Heller 1976 (ISOTYPE).

Puccinia ripulae Mains, Bull. Torrey Bot. Club 66: 620. 1939.

On *Baccharis glutinosa*. U. S. A.: Texas, Alamo, 15 Apr 1933, E. Clover 1130 (ISOTYPE).

≡ *Puccinia riparia* Mains, Pap. Michigan Acad. Sci. 22: 156. 1937. non *Puccinia riparia* Holway, J. Mycol. 10: 163. 1904.

= *Puccinia melampodii* Diet. & Holw., in Cummins. Rust fungi on legumes and composites in North America p. 106. 1978.

Puccinia seposita Cummins, Bull. Torrey Bot. Club 76: 33. 1949.

On *Benzoin sp.* China: Kwangsi, Ling Wang Shan, San Kiang Hsien, 19 Sep 1933, S. Y. Cheo 2817 (ISOTYPE).

Ravenelia portoricensis Arthur, Bull. Torrey Bot. Club 31: 5. 1904.

On *Cassia emarginata*. Porto Rico: limestone hills E of Ponce, 3 Dec 1902, A. A. Heller 6193 (ISOTYPE).

≡ *Ravenelia arthurii* Long in Stevenson, Contr. Reed Herb. 33: 288. 1975.

Uredo superior Arthur, Bull. Torrey Bot. Club 31: 5. 1904.

On *Fimbristylis spadicea*. Porto Rico: low ground W of Ponce, 2 Dec 1902, A. A. Heller 6279 (ISOTYPE).

= *Puccinia superior* Jackson in Jackson & Whetzel, Trans. Brit. Mycol. Soc. 13: 20. 1928.

Uredo superioris on the label.

Uredo velata Ell. & Ev., Bull. Torrey Bot. Club 22: 436. 1895.

On *Euphorbia cordata*. Hawaiian Islands: Oahu, Diamond Head, 28 Mar 1895, A. A. Heller 2027 (ISOTYPE).

Uromyces hellerianus Arthur, Bull. Torrey Bot. Club 31: 2. 1904.

On *Cayaponia racemosa*. Porto Rico: along the Adjuntas road 5 mi from Ponce, 4 Dec 1902, A. A. Heller 6206 (ISOTYPE).

= *Uromyces novissimus* Speg. in Lindquist, Royas de la Republica Argentina y zonas limitrofes p.205. Buenos Aires. 1982.

Uromyces helleriana on specimen label.

Aphyllophorales

Cantharellus luteocomus H. E. Bigelow, Mycologia 70: 733. 1978.

U. S. A.: Vermont, Lamoille Co., Stowe, Goldbrook Road, 13 Aug 1964, Bigelow 13436 (HOLOTYPE).

Clavaria cauliflorifomis Leathers, Mycologia 48: 278. 1956.

U. S. A.: Michigan, Topinabee, 1 Sep 1951, A. H. Smith & C. R. Leathers 319 (ISOTYPE).

Agaricales

Agrocybe occidentalis Watling & H. E. Bigelow, Mycotaxon 17: 388. 1983.

U. S. A.: Massachusetts, Hampshire Co., Amherst, University of Massachusetts Campus near Hasbrouck Laboratory, 21 May 1969, H. Ahles s.n., deposited in MASS as Bigelow 15625 (HOLOTYPE).

Agrocybe smithii Watling & H. E. Bigelow, Mycotaxon 17: 378. 1983.
U. S. A.: Massachusetts, Hampshire Co., Amherst, University of Massachusetts Campus near Clark Hall, 9 Jun 1967, Bigelow 15007 (HOLOTYPE).

Clitocybe acerba H. E. Bigelow, Beih. Nova Hedwigia 72: 99. 1982.
U. S. A.: Tennessee, Knox Co., New Hopewell, 4 Jan 1955, L. R. Hesler 21626 (ISOTYPE).

Clitocybe aromatica var. *olivascens* H. E. Bigelow, Beih. Nova Hedwigia 72: 70. 1982.
U. S. A.: Michigan, South Lyons, 5 Oct 1938, A. H. Smith 11118 (Frag. of HOLOTYPE).

Clitocybe atrofulva H. E. Bigelow, Beih. Nova Hedwigia 72: 135. 1982.
U. S. A.: Massachusetts, Leverett, Wilce Property, 13 Oct 1959, Bigelow 8748 (HOLOTYPE).

Clitocybe benekei H. E. Bigelow & A. H. Smith, Michigan Bot. 9: 30. 1970.
U. S. A.: Michigan, Macomb Co., Mt. Clemens, on mulch in rose beds in greenhouses, Mar & Apr 1969, A. H. Smith 77176 (ISOTYPE).

Clitocybe bubalina H. E. Bigelow & Miller in H. E. Bigelow, Beih. Nova Hedwigia 72: 145. 1982.
U. S. A.: Michigan, Oakland Co., Proud Lake, 20 Oct 1955, Bigelow 2854 (ISOTYPE).

In the publication Bigelow 2853 is mentioned as type collection. According to Bigelow's field book the number 2854 and 2853 are the same collection.

Clitocybe californiensis H. E. Bigelow, Beih. Nova Hedwigia 81: 295. 1985.
U. S. A.: California, Los Angeles Co., Pacific Palisades, Santa Ynez Canyon, 8 Jan 1979, G. Wright 1219 (HOLOTYPE).

Clitocybe cereceophylla H. E. Bigelow, Beih. Nova Hedwigia 81: 365. 1985.
U. S. A.: Tennessee, Knox Co., Timberlake Road, 30 Sep 1957, L. R. Hesler 22671 (ISOTYPE).

Clitocybe cereoceps H. E. Bigelow, Beih. Nova Hedwigia 72: 102. 1982.
U. S. A.: Washington, Pierce Co., Ashford, 22 Oct 1954, Bigelow 2386 (ISOTYPE).

Clitocybe epiphloeodica H. E. Bigelow, Beih. Nova Hedwigia 81: 381. 1985.
U. S. A.: Utah, Iron Co., Cedar Breaks National Monument, 19 Aug 1973, Bigelow 17246 (HOLOTYPE).

Clitocybe femoralis H. E. Bigelow, Sydowia 36: 14. 1983 [1984].
U. S. A.: California, San Mateo Co., near Belmont at Crystal Springs, San Francisco Watershed land, 1 Feb 1979, W. Sundberg 4198 (HOLOTYPE).

Clitocybe gibba var. *occidentalis* H. E. Bigelow, Beih. Nova Hedwigia 81: 293. 1985.
U. S. A.: California, San Mateo Co., San Francisco Watershed, 23 Dec 1966, H. D. Thiers 11823 (s.n. in publication) (ISOTYPE).

Clitocybe krizii-josephii Svrcek, Ceská Mykol. 29: 79. 1975.
Czechoslovakia: Bohemia, Ceska Lípa, on heaps of decayed twigs, leaves, and debris of various plants, 19 May 1974, Josephus Kriz s.n. (ISOTYPE).

Clitocybe mitis H. E. Bigelow, Lloydia 31: 55. 1968.
U. S. A.: Idaho, Valley Co., Lake Fork Creek Ranger Station, 28 Jun 1954, Bigelow 1664 (ISOTYPE).

Clitocybe oramophila H. E. Bigelow, Beih. Nova Hedwigia 72: 111. 1982.
U. S. A.: California, Humboldt Co., Patrick's Point State Park, 28 Nov 1980, Bigelow 18628 (HOLOTYPE).

Clitocybe rancida H. E. Bigelow, Mycologia 50: 45. 1958.

U. S. A.: Michigan, Emmet Co., Wilderness Park, 28 Sep 1953, A. H. Smith 43457 (ISOTYPE).

Clitocybe salmonilamella H. E. Bigelow, Mem. New York Bot. Gard. 28: 9. 1976.

U. S. A.: California, Marin Co., Muir Woods, 7 Dec 1971, Bigelow 16995 (HOLOTYPE).

Clitocybe sinopica var. *rimosa* H. E. Bigelow, Beih. Nova Hedwigia 81: 310. 1985.

U. S. A.: Michigan, Cheboygan Co., University of Michigan Biological Station near Burt Lake, 25 Jun 1952, A. H. Smith 38998 (ISOTYPE).

Clitocybe subfumosa H. E. Bigelow, Mycologia 50: 49. 1958.

U. S. A.: Michigan, Livingston Co., George Reserve, 10 Aug 1935, A. H. Smith 1777 (ISOTYPE).

Clitocybe thujana H. E. Bigelow, Beih. Nova Hedwigia 72: 142. 1982.

U. S. A.: Washington, Mt. Angeles, Ennis Creek, 7 Oct 1941, A. H. Smith 17618 (ISOTYPE).

Clitocybe ulmicola H. E. Bigelow, Beih. Nova Hedwigia 72: 135. 1983.

U. S. A.: Tennessee, Great Smoky Mountains National Park, Cades Cove, 20 Jul 1966, L. R. Hesler 29208 (ISOTYPE).

Clitocybe utahensis H. E. Bigelow, Beih. Nova Hedwigia 72: 194. 1982.

U. S. A.: Utah, Sanpete Co., above Pleasant Creek Camp, 27 Jul 1954, K. H. McKnight 888 (ISOTYPE).

Clitocybe venosa H. E. Bigelow, Beih. Nova Hedwigia 81: 396. 1985.

U. S. A.: Massachusetts, Franklin Co., Conway, Baptist Hill, 26 Nov 1961, Bigelow 10038 (HOLOTYPE).

Collybia compressiceps H. E. Bigelow, Rhodora 78: 124. 1976.

U. S. A.: Massachusetts, Leverett, 5 Aug 1969, N.Miller & W.Cibula s.n., deposited at MASS as Bigelow 15758 (HOLOTYPE).

= *Collybia luxurians* Peck, In: Halling, R. E. Mycologia Memoir 8: 67. 1983.

Collybia dysodes Halling, Mycologia Memoir 8: 79. 1983.

U. S. A.: Massachusetts, Hampshire Co., Amherst, Main St., near Plumbley's Restaurant, 28 Jul 1979, T. J. Baroni 3679 (HOLOTYPE).

Collybia subtergina Halling, Mycologia Memoir 8: 90. 1983.

U. S. A.: Massachusetts, Hampshire Co., Goshen, D. A. R. State Forest, 13 Oct 1962, Bigelow 11570 (HOLOTYPE).

Conocybe marginata Watling & H. E. Bigelow, Mycotaxon 17: 393. 1983.

U. S. A.: Massachusetts, Franklin Co., Conway, Baptist Hill, 30 May 1964, Bigelow 12546 (HOLOTYPE).

Fayodia alutacea H. E. Bigelow, Mycotaxon 9: 39. 1979.

U. S. A.: Vermont, Lamoille Co., Stowe, Ranch Brook, 1 Sep 1964, Bigelow 13814 (HOLOTYPE).

Hebeloma sporadicum A. H. Smith, Mycologia 30: 34. 1938.

U. S. A.: Michigan, Ann Arbor, Saginaw Forest under spruce, 7 Oct 1936, A. H. Smith 5050 (ISOTYPE).

Hygrophorus fibrillosus H. E. Bigelow, Rhodora 71: 182. 1969.

U. S. A.: Vermont, Washington Co., Monroe State Park, 6 Aug 1964, Bigelow 13331 (HOLOTYPE).

= *Tricholoma umbrosum* Smith & Walters, Mycologia 35: 477. 1943.

Hygrophorus mississippiensis Cibula, Mycotaxon 10: 106. 1979.

U. S. A.: Mississippi, Saucier, De Soto National Forest, Harrison Experimental Forest, 8 Aug 1974, W. Cibula 485 (HOLOTYPE).

Hygrophorus purpureofolius H. E. Bigelow, Rhodora 62: 190. 1960.
U. S. A.: Massachusetts, Savoy State Forest, North Pond, 7 Aug 1959, Bigelow 8363 (HOLOTYPE).

Lactarius hibbardae var. *glaucescens* L. R. Hesler & A. H. Smith, North American Species of Lactarius, p. 402. 1979.
U. S. A.: Vermont, Lamoille Co., near Mt. Mansfield, Ranch Brook trail, 28 Sep 1964, Bigelow 14261 (ISOTYPE).

Lactarius psammicola A. H. Smith, Pap. Michigan Acad. Sci. 26 (1940): 62. 1941
U. S. A.: Michigan, near Dexter, 5 Aug 1935, A. H. Smith 1710 (ISOTYPE).

The specimen label has different information on the locality: Pinckney, Silver Lake, Michigan. But all other data agree with the type collection.

Lactarius tephropeplis L. R. Hesler & A. H. Smith, North American Species of Lactarius, p. 390. 1979.
U. S. A.: New Hampshire, South Conway, Brownfield Road, 4 Sep 1963, Bigelow 12432 (ISOTYPE).

Lepiota cystidiosa A. H. Smith, Pap. Michigan Acad. Sci. 27: 58. 1941.
U. S. A.: Michigan, Washtinaw Co., Ann Arbor, 9 Sep 1940, A. H. Smith 1568 (HOLOTYPE).

Monaldelphus umbriniceps Murr., Quart. J. Florida Acad. Sci. 4: 181. 1941.
U. S. A.: Florida, Gainesville, s.d., W. A. Murrill 3522. (ISOTYPE).

= *Clitocybe umbriniceps* Murr., Quart. J. Florida Acad. Sci. 8: 198. 1945.

Mycena macilenta H. E. Bigelow, Rhodora 78: 126. 1976.
U. S. A.: Massachusetts, Wendell State Forest, Ruggles Pond, 12 Aug 1969, Bigelow 15801 (HOLOTYPE).

Mycena madorophila H. E. Bigelow, Rhodora 78: 129. 1976.
U. S. A.: Massachusetts, New Salem, off Rt. 202, 23 Jul 1968, Bigelow 15484 (HOLOTYPE).

Omphalotus olivascens H. E. Bigelow, O. K. Miller & Thiers, Mycotaxon 3: 363. 1976.
U. S. A.: California, San Mateo Co., near Boulder Creek, on Rt. 9, 9 Dec 1971, Bigelow 17015 (ISOTYPE-2 boxes).

Phaeocollybia rufipes H. E. Bigelow, Rhodora 65: 297. 1963.
U. S. A.: Maine, Piscataquis Co., Baxter State Park, Katahdin Lake Trail, 1 Sep 1962, Bigelow 11478 (HOLOTYPE (2 boxes)).

Rhodocybe mairei Baroni, Beih. Nova Hedwigia 67: 108. 1981.
U. S. A.: Massachusetts, Hampshire Co., Amherst, University of Massachusetts Campus, 11 Sep 1974, T. Baroni 1555 (HOLOTYPE).

Rhodocybe priscua Baroni, Beih. Nova Hedwigia 67: 60. 1981.
Canada: New Brunswick, Kouchibouguac National Park, 5 Oct 1978, S. A. Redhead 2695 (HOLOTYPE).

Hyphomycetes

Cercospora arcti-ambrosiae Halsted, Bull. Torrey Bot. Club 20: 251. 1893.
On leaves of *Ambrosia trifida*. U. S. A.: New Jersey, New Brunswick, Sep 1892, F. L. Stevens Econ. Fungi 297. (Possible SYNTYPE).

On leaves of burdock, *Arctium lappa*. U. S. A.: New Jersey, New Brunswick, Sep 1892, F. L. Stevens Econ. Fungi 296. (Possible SYNTYPE).

Cercospora brachypus Ell. & Ev., J. Mycol. 8: 71. 1902.

On leaves of *Vitis rotundifolia*. Alabama: Tuskegee, 20 Sep 1901, G. W. Carver s.n., Fungi Col. 1515. (Possible ISOTYPE).

= *Mycosphaerella angulata* Jenkins fide Chupp, A monograph of the fungus genus *Cercospora* p.602. Cornell Univ. Press: Ithaca. 1953 (1954).

Cercospora cephalanthi Ell. & Kellerman, Bull. Torrey Bot. Club 11: 121. 1884.

On leaves of *Cephalanthus occidentalis*. U. S. A.: Kansas, Manhattan, Jul 1884, W. A. Kellerman s.n., NAF 1510 (Possible ISOTYPE).

≡ *Ramularia cephalanthi* (Ell. & Kellerman) Heald, U. S. D. A. Bur. Pl. Industr. Bull. 226: 61. 1912.

Cercospora chionea Ell. & Kellerman, Bull. Torrey Bot. Club 11: 122. 1884.

On leaves of *Cercis canadensis*. U. S. A.: Kansas, Manhattan, Jul 1884, W. A. Kellerman s.n., NAF 1515 (Possible ISOTYPE).

Cercospora commonsii Sacc. nom. nov. for *C. stylosanthis* Ell. & Ev. (1887) non Speg. (1887). Sylloge Fungorum 10: 623. 1892.

On dead parts of leaves of *Stylosanthes elatior*. U. S. A.: Delaware, Faulkland, Sep 1886, A. Commons s.n., NAF 1764 (Two Possible ISOTYPES).

≡ *Cercospora stylosanthis* Ell. & Ev., J. Mycol. 3: 13. 1887.

Cercospora conspicua Earle, Bull. New York Bot. Gard. 3: 312. 1905.

On living leaves of *Cleome pentaphylla*. Porto Rico: low ground near Ponce, 28 Nov 1902, A. A. Heller 6152 (ISOTYPE).

≡ *Pseudocercospora conspicua* (Earle) Deighton, Mycol Pap. 140: 30-34. 1976.

Cercospora eustomae Peck, Ann. Rep. New York State Mus. (for 1911) 65: 45. 1912.

On living leaves of *Eustoma andrewsii*. U. S. A.: Colorado, Denver, 29 Sep 1909, E. Bethel s.n., Fungi Col. 3804 (Possible SYNTYPE).

Cercospora gaultheriae Ell. & Ev., J. Mycol. 2: 2. 1886.

On living leaves of *Gaultheria procumbens*. U. S. A.: New Jersey, Newfield, Jul 1885, NAF 1514 (Two possible ISOTYPES).

Cercospora heucherae Ell. & Martin, Amer. Naturalist 18: 189. 1884.

On leaves of *Heuchera americana*. U. S. A.: Pennsylvania, Chester Co., Jul 1882, G. Martin s.n. NAF 1258 (Possible ISOTYPE).

Cercospora isanthi Ell. & Kellerman, Bull. Torrey Bot. Club 11: 115. 1884.

On leaves of *Isanthus coeruleus*. U. S. A.: Kansas, Manhattan, Aug 1884, W. A. Kellerman s.n., NAF 1513 (Two possible ISOTYPES).

Cercospora juglandis Kellerman & Swingle, J. Mycol. 5: 77. 1889.

On lower leaves of medium sized trees of *Juglans nigra*. U. S. A.: Kansas, Manhattan, 19 Aug 1887, Kansas Fungi 34 (Possible ISOTYPE).

Kansas Fungi 34 is not mentioned in the original description. Kellerman 1079 is type collection according to the publication.

Cercospora juncina Sacc., Ann. Mycol. 11: 552. 1913.

On stems of *Juncus canadensis*. Canada: Ontario, London, 12 Aug 1910, J. Dearness s.n., Fungi Col. 4903 (Possible ISOTYPE).

Cercospora kalmiae Ell. & Ev., Proc. Acad. Nat. Sci. Philadelphia 1891: 88. 1891.

On living leaves of *Kalmia latifolia*. U. S. A.: New Jersey, Newfield, 1890, NAF 2591 (Possible ISOTYPE).

Cercospora kansensis Sydow, Ann. Mycol. 5: 340. 1907.

On leaves of *Carduus altissimus*. U. S. A.: Kansas, Lebanon, Aug 1906, Bartholomew s.n., Fungi Col. 2506 (Possible ISOTYPE).

Cercospora latens Ell. & Ev., J. Mycol. 4: 3. 1888.

On *Lespedeza capitata*. U. S. A.: Kansas, Manhattan, Jun 1887, W. T. Swingle s.n., NAF 2298 (Possible ISOTYPE).

A different host is named in the original publication: "On leaves of *Psoralea argophylla*." However, the two host species may be confused easily (J. Grimes, pers. comm.). Host name corrected in Chupp, A Monograph of the fungus genus *Cercospora*. 1954.

Cercospora lateritia Ell. & Halsted, J. Mycol. 4: 7. 1888.

On living leaves of *Sambucus pubens*. U. S. A: Iowa, Ames, Sep 1887, B. D. Halsted s.n., NAF 1994 (Possible ISOTYPE).

Cercospora molluginis Halsted, Bull. Torrey Bot. Club 20: 251. 1893.

On leaves of *Mollugo verticillata*. U. S. A.: New Jersey, Short Hills, Sep 1892, B. D. Halsted s.n., Econ. Fungi 286 (ISOTYPE).

Cercospora oculata Ell. & Kellerman, Bull. Torrey Bot. Club 11: 116. 1884.

On leaves of *Vernonia baldwinia*. U. S. A.: Kansas, Manhattan, Jul 1884, W. A. Kellerman s.n., NAF 1519 (Possible ISOTYPE).

Cercospora platanicola Ell. & Ev., J. Mycol. 3: 17. 1887.

On leaves of *Platanus occidentalis*. U. S. A.: Louisiana, Point de la Hache, Oct 1886, Rev. A. B. Langlois s.n, NAF 1766 (Possible ISOTYPE).

Cercospora polygonacea Ell. & Ev., J. Mycol. 1: 24. 1885.

On leaves of *Polygonum convolvulus*. U. S. A.: New Jersey, Newfield, Aug 1882, Ellis NAF 1254 (ISOTYPE).

Cercospora portoricensis Earle, Muhlenbergia 1: 15. 1900

On living leaves of *Piper aduncum*. Porto Rico: 2 mi NE of Mayaguez, 23 Jun 1900, A. A. Heller 4359a (ISOTYPE).

= *Pseudocercospora piperis* (Pat.) Deighton, Mycol. Pap. 140: 150. 1976.

Cercospora prunicola Ell. & Ev., J. Mycol. 3: 17. 1887.

On leaves of *Prunus americanus*. U. S. A.: Louisiana, Point de la Hache, Oct 1886, Rev. A. B. Langlois s.n., NAF 1771 (Possible ISOTYPE).

≡ *Cercoseptoria prunicola* (Ell. & Ev.) Yen, Bull. Soc. Mycol. France 97: 92. 1981.

Cercospora ratabidae Ell. & Barth., J. Mycol. 8: 177. 1902.

On *Ratabida columnaris*. U. S. A.: Kansas, Rooks Co., 19 Jul 1902, Bartholomew s.n., Fungi Col. 1713 (Possible ISOTYPE).

Cercospora richardsoniae Ell. & Ev. non *C. richardsoniae* Henn., J. Mycol. 8: 72. 1902.

On leaves of *Richardsonia scabra*. U. S. A.: Alabama, Tuskegee, 31 Aug 1900, G. W. Carver s.n., Fungi Col. 1612 (Poss. ISO- or SYNTYPE).

≡ *Cercospora carveriana* Sacc. & Sacc., Sylloge Fungorum 18: 607. 1906.

Cercospora sii Ell. & Ev., J. Mycol. 5: 71. 1889.

On leaves of *Sium cicutaefolium*. U. S. A.: Wisconsin, Racine, Sep 1888, J. J. Davis s.n., NAF 1974. (Possible ISOTYPE).

Cercospora streptopi Dearn. & Barth., Mycologia 9: 363. 1917.

On living leaves of *Streptopus amplexifolius*. U. S. A.: Washington, Duckabush River, 13 Aug 1912, Bartholomew s.n., Fungi Col. 5004. (ISOTYPE).

Cercospora stylosanthis Ell. & Ev., J. Mycol. 3: 16. 1887. See *C. commonsii*.

Cercospora zizae Ell. & Ev., J. Mycol. 3: 16. 1887.

On leaves of *Zizia cordata*. U. S. A.: Pennsylvania, West Chester, Jul 1886, Everhart s.n., NAF 1998 (Possible ISOTYPE).

Cercosporidium helleri Earle, Muhlenbergia 1: 16. 1900.

On living leaves of *Sphenoclea zeylanica*. Porto Rico: in moist ground near Anasco, 6 Feb 1900, A. A. Heller 4537 (ISOTYPE).

Coniosporium corticale Ell. & Ev., J. Mycol. 5: 69. 1889.

In bark of maple logs. Canada: Ontario, London, May 1889, J. Dearness s.n. NAF 2796. (Possible ISOTYPE).

≡ *Cryptostroma corticale* (Ell. & Ev.) Gregory & Waller, Trans. Brit. Mycol. Soc. 34: 593. 1951.

Coryneum rhois Halsted, Bull. Torrey Bot. Club 20: 251. 1893.

On leaves of *Rhus radicans*. U. S. A.: New Jersey, New Brunswick, Sep 1892, F. L. Stevens s.n., Econ. Fungi 272 (ISOTYPE).

≡ *Colletogloeum rhois* (Halsted) Sutton, Mycol. Pap. 138: 165. 1975.

Sutton stated that there was a discrepancy between the collection date given in the original description by Halsted (1882) and the date on the specimen label (1892). Sutton's observation is based on an error. Halsted's original species description does mention the correct collection date, 1892, also found on the label. In the preceding paragraph, Halsted mentions a collection of *Tubercularia rhois* collected in Sep 1882, which also occurs on leaves of *Rhus radicans*. Sutton must have interchanged the paragraphs while reading the collection date.

Gliocephalotrichum bulbilium J. J. Ellis & Hesseltine, Bull. Torrey Bot. Club 89: 21-27. 1962.

From soil. U. S. A.: Louisiana, Tunica Hills, Wickerham, Aug 1960, subcultured Oct 1970, QM 9007, ex type culture NRRL 2899 (Culture ex TYPE).

Gliocephalotrichum cylindrosporum Wiley & Simmons, Mycologia 63: 582. 1971.

Isolated from soil. Thailand: Pak Thong Chai, Dec 1967, C. Klinsukont s.n., QM 9009 (ISOTYPE).

Morrisographium persicae (Schwein.) Illman & G. P. White, Mycotaxon 19: 147. 1984.

On dead limbs of cherry. U. S. A.: New Jersey, Newfield, Jan 1880, Ellis NAF 946 (ISONEOTYPE).

≡ *Periconia persicae* Schwein., Schriften Naturf. Ges. Leipzig 1: 125. 1822.

≡ *Sphaeronema persicae* (Schwein.:Fr.) Ellis in NAF 946. 1883.

≡ *Cornularia persicae* (Schwein.) Sacc., Sylloge Fungorum 3: 599. 1884.

See Mycotaxon 19: 147. 1984. for a complete list of synonyms.

Scolecotrichum punctulatum Tracy & Earle, Bull. Torrey Bot. Club 22: 178. 1895.

On *Iris pabularia*. U. S. A.: Mississippi, Starkville, 1 Jan 1894, S. M. Tracy s.n. (Probable ISOTYPE).

Sphaeronaema hispidulum Ell., Bull. Torrey Bot. Club. 6: 106.

On dead twigs of *Nyssa multiflora*. U. S. A.: New Jersey, Newfield, Oct 1875, Ellis NAF 113 (ISOTYPE).

≡ *Morrisographium hispidulum* (Ell.) Illman & G. P. White, Canad. J. Bot. 63: 425. 1985.

Coelomycetes

Aschersonia marginata Ell. & Ev., Bull. Torrey Bot. Club 22: 436. 1895.

On living leaves of *Psidium guayaya*. Hawaiian Islands: Oahu, in and on the slopes of Makiki, 18 Mar 1895, A. A. Heller 1945. (ISOTYPE).

Asterinula langloisii Ell. & Ev., J. Mycol. 5: 152. 1889.

On the under side of living leaves of *Magnolia grandiflora*. U. S. A.: Louisiana, , Jan 1889, A. B. Langlois s.n. NAF 2572 (Possible ISOTYPE).

≡ *Leptothyriella langloisii* (Ell. & Ev.) Sacc., Sylloge Fungorum 10: 426. 1892.

Chaetasbolisia californiana Bat., Cif. & Nasc., Quaderno 31: 57. 1963.

On leaves of *Photinia (Heteromeles) arbutifolia*. U. S. A.: California, Berkeley, Mar 1893, W. C. Blasdale NAF 2918 as *Cap-*

nodium heteromeles Cooke & Harkness (Possible ISOTYPE).

Colletotrichum cereale Manns, Bull. Ohio Agricultural Experiment Station 203: 207. 1909.

On culms of Valley Wheat, *Triticum vulgare L.* U. S. A.: Ohio, Sharpsburg, 23 Jun 1908, A. D. Selby s.n. (SYNTYPE).

On culms of Gypsy Wheat, *Triticum vulgare.* U. S. A.: Ohio, Wooster, Ohio Experimental Station, 23 Jun 1908, A. D. Selby and W. F. Selby s.n. (SYNTYPE).

On culms and spikes of rye, *Secale cereale.* U. S. A.: Ohio, Chillicothe, 16 Jul 1908, J. M. Van Meter s.n. (SYNTYPE).

On culms of Timothy, *Phleum pratense.* U. S. A.: Ohio, Wooster, Ohio Experiment Station, Jul 1908, A. D. Selby s.n. (SYNTYPE).

On culms of Orchard grass, *Dactylis glomerata.* U. S. A.: Ohio, Wooster, Ohio Experiment Station, 1908, A. D. Selby s.n. (SYNTYPE).

On culms and sheaths of volunteer oats, *Avena sativa.* U. S. A.: Ohio, Sharpsburg, 4 Jul 1908, A. D. Selby s.n. (SYNTYPE).

On culms and sheaths of volunteer chess, *Bromus secalinus.* U. S. A.: Ohio, Sharpsburg, 4 Jul 1908, A. D. Selby s.n. (SYNTYPE).

Colletotrichum violae-tricoloris R. E. Smith, Bot. Gaz. (Crawfordsville) 27: 203. 1899.

Parasitic on leaves and petals of cultivated pansy, *Viola tricolor.* U. S. A: Massachusetts, Belchertown, Aug 1898, R. E. Smith s.n. (HOLOTYPE).

The original description does not designate holo- or isotypes. However, since Smith worked in Amherst at the time, our specimen is probably the holotype.

Gymnoxyphium malum Bat., Nasc. & Cif., Quaderno 31: 86. 1963.

On dead branch of *Pyrus malus.* U. S. A.: New York, Alcove, Oct 1893, Shear, New York Fungi 148 as *Capnodium elongatum* B. & Desm.? (ISOTYPE).

Phoma corvina Rav., Sylloge Fungorum 10: 171. 1892.

On stems of *Gossypium.* U. S. A.: South Carolina, s.d., Ravenel 588 (ISO- or HOLOTYPE).

≡ *Sphaeria corvina* is another annotation on the specimen label, but no reference to this name could be found.

Phyllosticta scaevola Ell. & Ev., Bull. Torrey Bot. Club 22: 436. 1895.

On leaves of *Scaevola chamissoniana.* Hawaiian Islands: Oahu, along Tantalus, 11 Apr 1895, A. A. Heller 2124 (ISOTYPE).

Steganosporium formosum Ell. & Ev., Bull. Torrey Bot. Club 10: 76. 1883.

On dead limbs of *Magnolia acuminata.* U. S. A.: Pennsylvania, West Chester, Jun 1883, Everhart & Haines s.n., NAF 1176 (Possible TYPE).

Possible *Steganosporium* conidial state of *Pleomassaria maxima* Ell. & Ev. (Barr, pers. comm.)

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MYCOTAXON

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AMANITA SMITHIANA—TAXONOMY, DISTRIBUTION, AND POISONINGS

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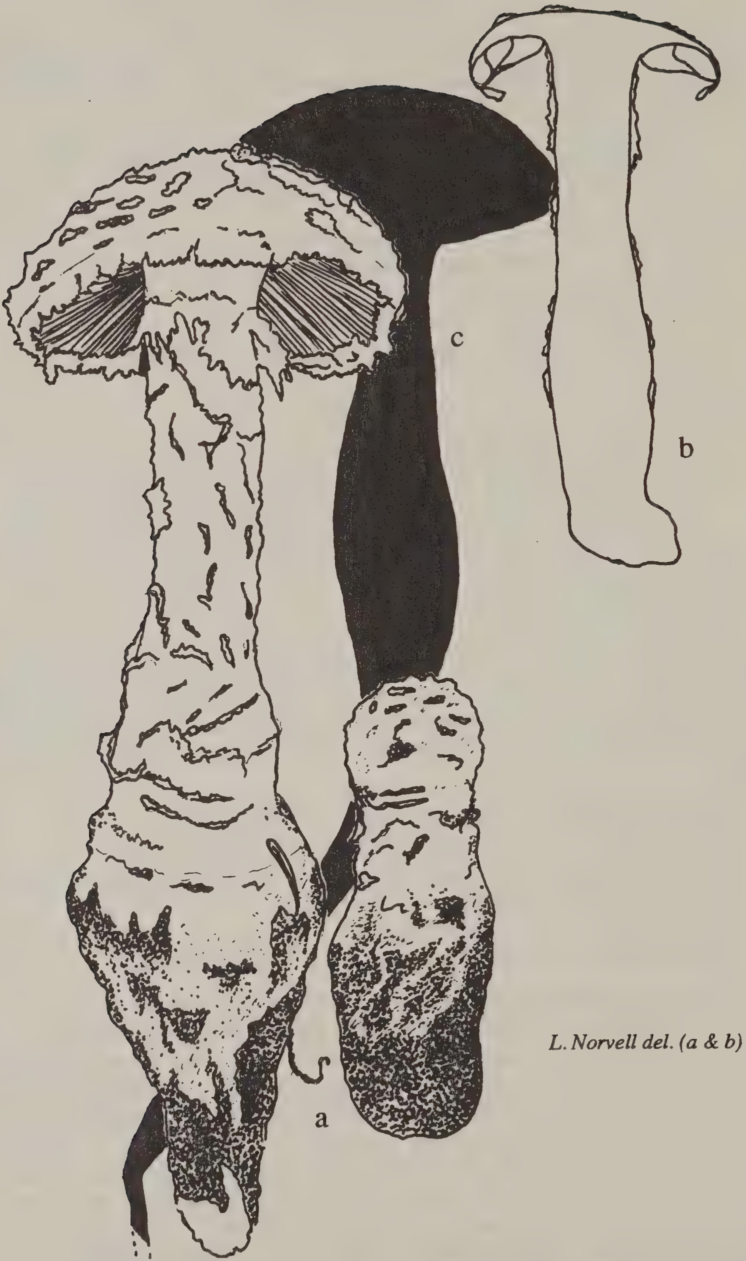
Summary

Recent poisonings attributed to *Amanita smithiana* motivated a study of this species which is common in the northwestern U.S. and southwestern Canada. Expanded morphological, ecological, and distribution information is provided. Past studies of free amino acids in *A. smithiana* are summarized. Poisonings attributed to this entity are described.

Amanita smithiana (Fig. 1) belongs to *Amanita* subgenus *Lepidella* (E. J. Gilb.) Veselý *emend.* Corner & Bas section *Lepidella* subsection *Solitariae* Bas stirps *Rhopalopus.* It is a medium- to large-sized, white mushroom with an appendiculate pileus margin and a squamulose stipe which may become glabrous with age and which terminates in a bulb that is often rather long and fusiform and difficult to collect in its entirety.

AMANITA SMITHIANA Bas. 1969. *Persoonia* 5: 418, illus.
=*Amanita solitaria sensu* Hotson. 1936. *Mycologia* 28: 72, illus.
=*Amanita solitaria sensu* Stuntz *in* Benedict *et al.* 1966. *Lloydia* 29(4): 335.
Illus.: Lincoff. 1981. *Audubon.* Fig. 165.
Illus.: Jenkins. 1986. *Amanita*: Fig. 64.
Illus.: McKenny and Stuntz (rev. Ammirati). 1987. *Savory*: 42.

PILEUS: 50 - 170 mm wide, white or whitish or ivory, sometimes becoming pale tan in dry weather, infrequently with pinkish staining, sometimes yellowish on margin from handling or drying, subviscid at first, remaining tacky when moist, becoming shiny on drying and taking on texture of smooth kid leather, hemispherical at first then convex to planoconvex, sometimes subumbonate; *context* white, unchanging when cut or bruised, up to 15 - 20 mm thick at the stipe, thinning evenly to margin which projects slightly beyond ends of lamellae; *margin* nonstriate, appendiculate with dense white floccose submembranous material, decurved at first, finally flaring upward in age; *universal veil* white to whitish to pale buff to pale pinkish buff to cream buff to tan to brownish, darker colors apparently attributable to effects of warm, dry weather and/or age, occurring as floccose/felted patches (especially in warm, dry weather) or occasionally as easily crushed subpyramidal or subconical warts especially over disk (especially in moist, cool weather), in either case reduced to unevenly distributed finer


c
b
a
L. Norvell del. (a & b)

Figs. 1a-1c *Amanita smithiana*. Figs. 1a [×0.65] & 1b [×0.25] Habit (Norvell LLN111290-2); note broken bulb tip of larger basidiocarp of Fig. 1a. Fig. 1c Silhouette showing extended radical, based on tracing of unretained specimen [≈×0.5].

flocculence toward margin, detersile as long as pileipellis remains moist.

LAMELLAE: free to narrowly adnate, sometimes with a faint decurrent line on stipe apex, close to crowded, white to cream to ivory to pale pinkish buff in mass, in side view clay white or occasionally translucent, sometimes becoming cream in age, 6 - 11 mm broad, broadest about half way from stipe to margin, rarely forking, with white fimbriate-flocculose edge; *lamellulae* truncate to rounded truncate (shorter ones) to attenuate (longer ones), often unevenly distributed among lamellae.

STIPE: 60 - 160 × 10 - 35 mm, white, bruising slowly buff to pinkish buff where handled, cylindric or narrowing upward, decorated with floccose/squamulose zones that can disappear with age and with fibrils that may become somewhat brownish; *context* white, unchanging when cut or bruised, usually solid, occasionally with a short, hollow lumen, commonly lacking insect tunnels; *bulb* white, broadly or narrowly fusiform, occasionally with an extended radical that is very difficult to collect in its entirety and is usually missed in whole or part by collectors, up to 130^{+} × 55 mm, with occasional radical adding up to 300 mm to length; *partial veil* as a floccose-fibrillose-submembranous annulus, superior, ragged or lacerate; *universal veil* in broken rings of irregular warts at top of bulb, detersile.

Odor[1] absent to mild to somewhat faintly pungent or "salty" or like dust from ground bark of *Pseudotsuga menziesii* (Mirb.) Franco (locally familiar because of its use as garden mulch) to yeast-like or with cut surfaces smelling like green tomatoes or tomato plants, very strong and unpleasant in age ("almost 'hammy' odor with tinges of chlorine"), "truly obnoxious when in decline". *Taste* mild to somewhat sweet or lacking. The person poisoned in the 1976 poisoning case (see discussion, below) provided additional information on taste: a young basidiocarp fried had "superb" flavor which was somewhat raphanoid. An older basidiocarp fried was considered "fair...raphanoid, moderately acidic-bitter." POISONOUS.

MACROCHEMICAL SPOT TESTS: Results were reported by G. J. Breckon (1968): $FeSO_4$, negative; 3% KOH, negative; Melzer's reagent on flesh, negative; phenol, negative to weakly positive; phenolaniline, negative to weakly positive; tincture of guaiac, slowly and weakly positive. Lindgren has generally confirmed these results: $FeSO_4$, 10% KOH, PADAB, 95% ethanol all negative; paracresol test for tyrosinase (Marr, 1979) positive except in base of bulb and in lamellae, with strongest reaction in top third of stipe (visible in about 5 min.); syringaldazine test for laccase (Marr, 1979) positive in a line parallel to pileipellis and about 2 mm below it in pileus context, also in spots on lamellae and very tip of bulb.

PILEIPELLIS: 70 - 100 µm thick; filamentous, undifferentiated hyphae 1.0 - 8.7 µm wide, colorless, branching, densely interwoven, subradially arranged; oleiferous hyphae not observed. PILEUS CONTEXT: filamentous, undifferentiated hyphae 1.8 - 11.5 µm wide, plentiful, branching, interwoven, subradial orientation dominant for

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[1] Odors in quotation marks are taken from the field notes on Norvell LLN11290-2. The remaining odors are from the collecting notes of Lindgren.

most of pileus thickness, more disordered near lamellae; inflated cells thin-walled, narrowly ventricose to elongate to narrowly clavate, up to 98 × 36 µm, terminal or in short chains, with only terminal cells fully inflated; oleiferous hyphae 3.2 - 6.5 µm wide, not common, branching, apparently more frequent near lamellae; clamps present. LAMELLA TRAMA: bilateral, rather broad, with angle of divergence 20° to 60°, mostly under 45°; central stratum pronounced; filamentous, undifferentiated hyphae 1.2 - 7.0 µm wide, branching, with some intercalary segments subinflated ventricose to 11.0 µm wide; inflated cells apparently absent; oleiferous hyphae 2.0 - 8.5 µm wide, rather scarce to plentiful and then branching and entangled. SUBHYMENIUM: uninflated or barely inflated to narrowly clavate branching hyphal segments running roughly perpendicular to central stratum. BASIDIA: 43 - 70 × 8.5 - 13.8 (-15.0) µm, dominantly 4-, also, occasionally, 1-sterigmate, rarely 2- or 3-sterigmate, thin-walled, slenderly clavate; clamps and proliferated clamps rather common. UNIVERSAL VEIL: On pileus: filamentous, undifferentiated hyphae 1.8 - 12.2 µm wide, plentiful, branching, with some segments inflated to 22 µm wide; inflated cells terminal or in chains that are vertically aligned in warts, subglobose to broadly ellipsoid to ovoid to ellipsoid to broadly clavate to clavate, up to 77 × 63 µm, with walls slightly thickened; oleiferous hyphae 1.4 - 9.1 µm wide; near pileipellis there is a thin layer of hyphae that run parallel to hyphae of pileipellis; very well illustrated by Bas (1969: 421, Fig. 144). On stipe base: absent. STIPE CONTEXT: acrophysalidic; filamentous, undifferentiated hyphae 1.0 - 8.0 µm wide, dominant, branching; acrophysalides very slender, thin-walled, difficult to distinguish, up to 262 × 25 µm, possibly longer; oleiferous hyphae scarce or absent. PARTIAL VEIL: filamentous, undifferentiated hyphae 1.0 - 9.0 µm wide, interwoven, branching, with many branches disordered, often in fascicles which are oriented radially (apparently causing tissue to split roughly radially in crush mount), plentiful; inflated cells plentiful to dominating, unevenly distributed, sometimes clustered, thin-walled, terminal or in short chains, gelatinizing, bacilliform to cylindrical to narrowly clavate to clavate to fusiform to ellipsoid to subpyriform, up to 71 × 34 µm (such cells distributed throughout tissue and distinguishable from cells which separate the partial veil from the lamellae—these latter being more subglobose, yellower in 3% KOH[2], and more completely gelatinized); oleiferous hyphae 1.2 - 10.5 µm wide.

BASIDIOSPORES: [1912 from 96 specimens of 85 collections] (6.5-) 8.5 - 12.0 (-16.0) × (4.3-) 5.8 - 7.9 (-10.8) µm, (average length per specimen = (8.6-) 9.4 - 11.1 (-11.7) µm; average length overall = 10.4 µm; average width per specimen = (5.5-) 6.0 - 7.4 (-7.6) µm; average width overall = 6.8 µm; Q = (1.12-) 1.33 - 1.78 (-2.36); average Q per specimen = (1.29-) 1.43 - 1.68 (-1.98); average Q overall = 1.54), hyaline, thin-walled, smooth, amyloid to strongly amyloid, ellipsoid to elongate, often adaxially flattened, sometimes swollen at one end; apiculus sublateral, cylindric; contents guttulate or granular; white to pale cream in deposit.

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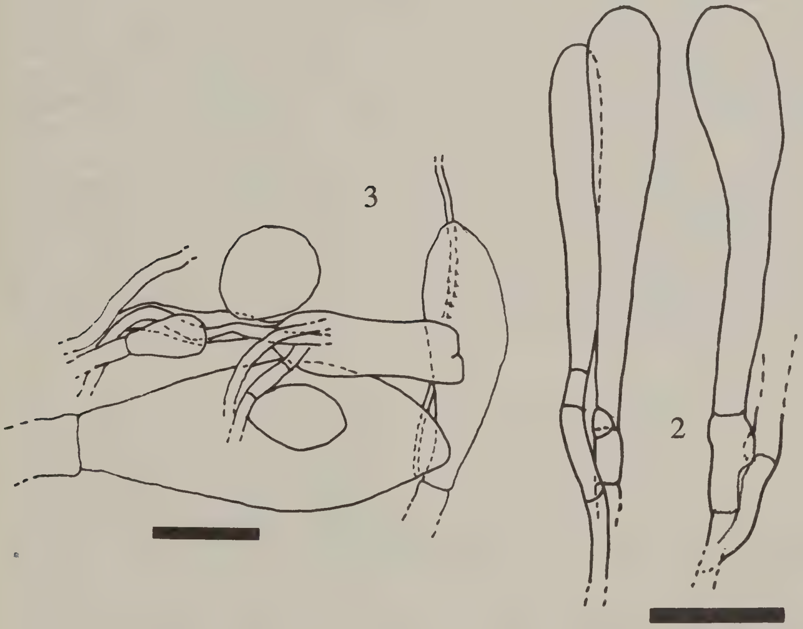
[2] Tissues were examined in 3% KOH. Spores were examined in Melzer's Reagent, 3% KOH and 10%NH_4OH.

Distribution and habitat: From central California north to southwestern British Columbia and from the Pacific coast eastward to northern Idaho in the northern portion of that range and to the foothills of the Sierra Nevada mountains in central California; to 770^+ m elev. Two isolated collections from considerably further south: in New Mexico at 2750 m elev. and from Santa Barbara Co., California, in sandy soil at about 920 m elev. Solitary to subgregarious to gregarious. In the main portion of the known range occurring September to December, occasionally in July, August, or January; one occurrence in May in the Sierra Nevada foothills. New Mexican material collected during August monsoon period.

The Big Lagoon collection is from *Picea sitchensis* (Bong.) Carr. and *Tsuga heterophylla* (Raf.) Sarg. woods. Lipse 415 was collected in *Picea* woods. Bull Run watershed collections were made in forest with overstory of *Pseudotsuga menziesii*, *T. heterophylla*, and *Acer glabrum* Torr. and understory of *Berberis nervosa* Pursh., *Gaultheria shallon* Pursh., and *Vaccinium parvifolium* Smith. Bothell and Bridal Trails State Park collections and A. H. Smith 17550 were made under *P. menziesii*. J. E. Lindgren 91-50 was collected at about 615 m elev. in 50 to 80 year old, second growth forest, predominantly *P. menziesii*, *T. heterophylla*, *Thuja plicata* Donn., and *Acer circinatum* Pursh. in an area of deep moss with plentiful woody debris and an



Figs. 2-3 *Amanita smithiana*. Fig. 2 elements of hymenium and subhymenium (holotype). Fig. 3 partial veil tissues (Norvell LLN111290-2). In Figs. 2-3, the dark bar indicates 20 µm.

understory including *G. shallon*, *Polystichum munitum* (Kaulf.) Presl., *Pteridium aquilium* (L.) Kuhn., and *B. nervosa*. A. H. Smith 17941 was found under *Alnus* and conifers. The 1978 Priest Lake, Idaho collection was made in forest of *P. menziesii* and *Larix sp.* Trappe 8301 is annotated ''hypogeous under Douglas fir''.

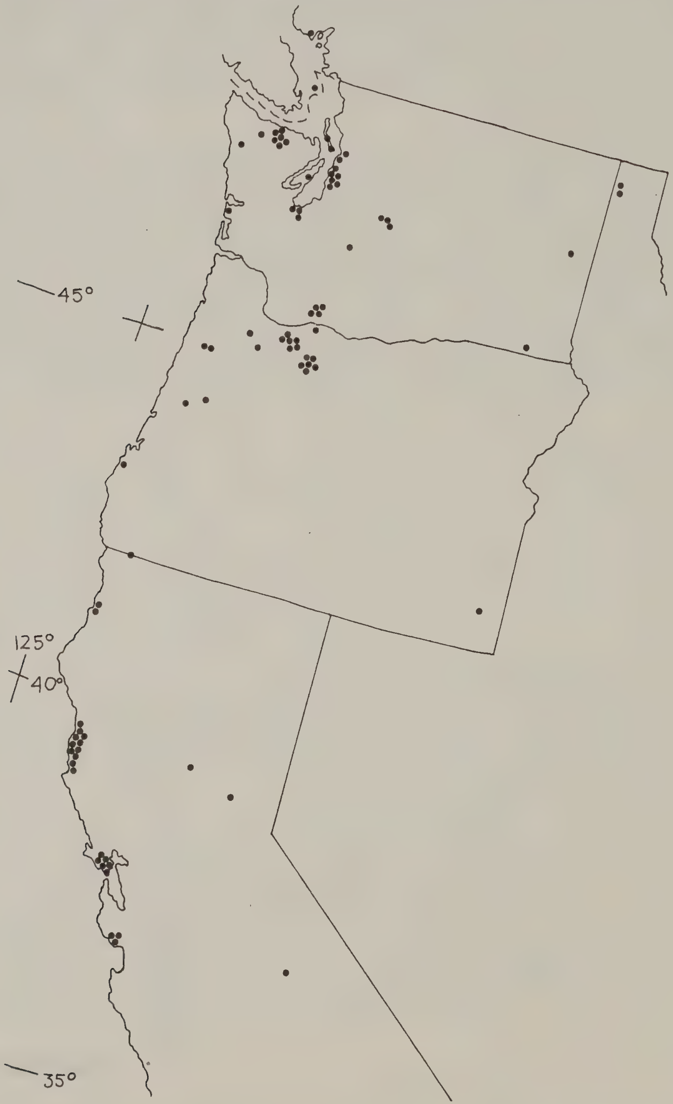


Fig. 4 *Amanita smithiana*. Distribution. Dots indicate the site of individual collections. In order to maintain a sufficiently large scale, the Santa Barbara Co., California, and New Mexico collections are not included.

Thiers (1982) reports that, in northern California, *A. smithiana* has been collected more often along the coast than in the mountains and is often associated with *Pinus spp*. Many collectors noted "under conifers" in all parts of the known range. Desjardin 857 and Thiers 41754 were collected under *P. muricata* D. Don; and Breckon 660, under *P. ponderosa* Dougl. *ex* Laws. M. Norris 54 (Oregon), P. K. Smith 148, and Breckon 221 were collected under *Quercus*. A. H. Smith 9472 is recorded from *Sequoia sempervirens* (D. Don) Endl. forest. The Santa Cruz collection of i.1992 was made near *Pinus* and *Arctostaphylos*. *Amanita smithiana* is often found growing amidst or near very rotten wood.

Distribution information is somewhat limited because *A. smithiana* has been considered so common that specimens collected at forays are often not retained. On the other hand we were fortunate enough to find a large number of collections in the herbaria we surveyed. These collections were made over a broad geographic region and over a period of 77 years. When the distribution of *A. smithiana* plotted in Fig. 4 is compared to maps of distribution of *P. menziesii* and *T. heterophylla* (Little, 1971), we note a very strong correlation. It is possible that the species may be found throughout the Douglas Fir/Western Hemlock Zone of the Pacific Northwest (Eyre, 1980).

Collections examined: **CANADA**: BRITISH COLUMBIA - Sechelt, 7[?].x.1988 Timothy McFarlane *s.n.* (WTU[3]); Saturna Island, 8.x.1984 Basil & Wendy Sagar *s.n.* [P. Kroeger pk812] (UBC F12291). **UNITED STATES**: CALIFORNIA—Butte Co. - Oroville, 16.v.1966 Harry D. Thiers *s.n.* [Gary J. Breckon 371] (SFSU). Fresno Co. - Rancheria Campground and Huntington Lake, 13.ix.1975 H. D. Thiers 34815 (SFSU). Humboldt Co. - Big Lagoon, 6.5 km N of Patrick Point, 15.x.1977 H. D. Thiers 38315 (SFSU); Eureka, 30.xi.1933 P. C. Richardson *s.n* [Fungi of Pacific States 287] (BPI); Murray Rd., 10.xi.1979 Jeane Rockas M174 (SFSU); Orick, 6.xii.1937 A. H. Smith 9472 (MICH as "*A. solitaria*"). Marin Co. - Alpine Lake, 25.xi.1979 P. K. Smith 148 (SFSU); Inverness, Inverness Ridge, 19.i.1981 Dennis E. Desjardin *s.n.* [H. D. Thiers 41752] (SFSU), 30.i.1981 D. E. Desjardin *s.n.* [H. D. Thiers 41754] (SFSU); Inverness Ridge, along Sunnyside Rd., 27.xi.1981 D. E. Desjardin 857 (SFSU); Phoenix Lake, 30.xi.1963 H. D. Thiers 10898 (SFSU); Tomales Bay St. Pk., 12.xi.1970 B. Shervanick 359 (SFSU). Mendocino Co. - Jackson St. For., 18.xi.1961 H. D. Thiers 8880 (SFSU),

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[3]

BPI - Herbarium, U. S. National Fungus Collections, Systematic Botany and Mycology Laboratory, Beltsville, Maryland, U.S.A.
F - Herbarium of the Field Museum of Natural History, Chicago, Illinois, U.S.A.
JEL - personal herbarium of J. E. Lindgren
L - Rijksherbarium, Leiden, The Netherlands
MICH - Herbarium of the University of Michigan, Ann Arbor, U.S.A.
NY - Herbarium of The New York Botanical Garden, Bronx, U.S.A.
OSC - Herbarium, Department of Botany and Plant Pathology, Oregon State University, Corvallis, U.S.A.
RET - personal herbarium of R. E. Tulloss
SFSU - Harry D. Thiers Herbarium, Department of Biology, San Francisco State University, California, U.S.A.
UBC - Herbarium, Department of Botany, University of British Columbia, Vancouver, Canada
WTU - Herbarium, Department of Botany, University of Washington, Seattle, U.S.A.

19.x.1962 H. D. Thiers 9270 (SFSU), 1.xii.1962 H. D. Thiers 9652 (SFSU), 7.xii.1963 H. D. Thiers 11101 (SFSU), 12.xi.1965 W. J. Sundberg *s.n.* [G. J. Breckon 264] (SFSU), 1.xii.1967 H. D. Thiers 21724 (SFSU), 9.xi.1969 Alix Wennekens 74 (SFSU), 11.xii.1969 H. D. Thiers 24477 (SFSU), xi.1977 B. Tamm *s.n.* (SFSU); Jackson St. For., near Ft. Bragg, Simpson Lane, 24.xi.1979 H. D. Thiers 40476 (SFSU); Jackson St. For., near Mendocino, 9.xi.1968 H. D. Thiers 23089 (SFSU). Nevada Co. - Skillman Campground, Hwy. 20, 13.x.1984 H. D. Thiers 47999 (SFSU). Santa Barbara Co. - no locality, 30.xi.1941 Edward Lewis *s.n.* [P. M. Rea 1037] (MICH as "*A. chlorinosma*"). Santa Cruz Co. - Graham Hill Rd., 10.xii.1966 H. D. Thiers *s.n.* [G. J. Breckon 660] (SFSU); Oram Hill Rd., 21.xi.1963 G. J. Breckon 221 (SFSU); near Santa Cruz, i.1992 David Arora *s.n.* (RET). IDAHO—Bonner Co. - Priest Lake, 30.ix.1972 A. H. Smith 82497 (MICH), 30.ix.1978 member of Spokane Mushroom Club *s.n.* (WTU as "*A. radicata* var. *solitaria* [sic]"). NEW MEXICO—Sandoval Co. - Jemez Mtns., viii.1981 Charles Barrows 1981-#15 (MICH). OREGON—Clackamas Co. - Mt. Hood National Forest (MHNF), Bull Run watershed, 6.ix.1989 J. E. Lindgren 182 (RET), 15.x.1989 J. E. Lindgren 185 (RET), 25.x.1990 J. E. Lindgren *s.n.* (RET); MHNF, 23.x.1988 Herman Oppgenorth *s.n.* [Lindgren 135] (RET); 11 km E of Woodlawn, 3.xii.1984 James M. Trappe 8301 (OSC 44695). Coos Co. - Bandon, *n.d.* Catherine Ardrey 1097 (WTU as "*A. smithii* [sic]"). Hood River Co. - MHNF, Herman Creek Trail, 4.xi.1987 J. E. Lindgren 108 (RET). Josephine Co./Siskiyou Co. (Calif.) line - U.S. Rte. 199, 20.ix.1937 A. H. Smith 8960 (MICH as "*A. solitaria*"). Lane Co. - Elmira, 11.xi.1943 Frank P. Lipse 415 (MICH as "*A. solitaria*"); no locality, 9.ix.1991 Freeman Rowe *s.n.* [Lindgren 91-56] (WTU; RET). Polk Co. - close to Black Rock Rd., W of Camp Tapawingo, 9.xi.1991 Dick Bishop & J. E. Lindgren [Lindgren 91-50] (WTU; JEL; RET); near Camp Tapawingo, 9.xi.1991 participants in Oregon Mycological Society foray [Lindgren 91-55] (WTU; RET). Wasco Co. - MHNF, Bear Springs, 24.x.1954 A. H. Smith 49468 (MICH); MHNF, Clear Creek area, 9.x.1973 R. Oswald 6 (MICH); MHNF, Skyline Rd., "Cascades", 16.x.1944 A. H. Smith 19810 (MICH); Warm Springs Indian Reservation (WSIR), Bear Springs, Mt. Wilson Rd., 25.x.1946 W. B. Gruber *s.n.* [A. H. Smith 24981] (paratype, MICH); WSIR, Beaver Creek, 21.x.1947 A. H. Smith 28106 (paratype, MICH). Washington Co. - Cipole Station, 12.xi.1942 W. B. Gruber *s.n.* (MICH as "*A. solitaria*"). WASHINGTON—Clallam Co. - Olympic Nat. Pk. (ONP), 12.x.1915 C. H. Kauffman *s.n.* (MICH as "*A. solitaria*"); ONP, Lake Mills, 15.x.1941 A. H. Smith 17941 (MICH as "*A. solitaria*"); ONP, Mt. Angeles, 4.x.1941 A. H. Smith 17550 (MICH as "*A. solitaria*"); ONP, Olympic Hot Springs, 2.x.1941 A. H. Smith 17501 (holotype, MICH; isotype, L (*n.v.*)), 10.x.1941 A. H. Smith 17802 (MICH as "*A. solitaria*"), 15.x.1941 A. H. Smith 17911 (MICH as "*A. solitaria*"). Columbia Co. - Tucannon River, Meadow Creek, 11.x.1980 A. H. Smith 90917 (MICH). Island Co. - Whidbey Island, 23.x.1966 K. A. Harrison 6476 (MICH as "*A. solitaria*"); Whidbey Island, Langley woods, 14.xi.1967 D. Hall *s.n.* [Stuntz 14537] (WTU as "*A. solitaria*"). Jefferson Co. - ONP, Elwha River below Lake Mills, 15.x.1941 A. H. Smith 17933 (MICH as "*A. chlorinosma*"); ONP, by Hoh River, near Hwy. 101, 7.x.1981 J. M. Trappe 6444 (OSC 40595). King Co. - near Bothel, 26.x.1958 D. E. Stuntz Is-735a (WTU as "*A. solitaria*"); Bridle Trails St. Pk., Bellevue, 12.xi.1990 Lorelei Norvell LLN111290-2 (WTU); near Redmond, Watermain Woods, 18.x.1975 D. E. Stuntz & students [Stuntz 19168] (WTU as "*A. solitaria*"); Seattle, N 240 St. woods, 9.x.1948 D. E. Stuntz 4860 (WTU as "*A. chlorinosma*"); Seattle, Holman Rd., x.1953 D. E. Stuntz 8629 (WTU as "*A. chlorinosma?*").

King/Snohomish Co. line - Point Wells, 18.x.1935 D. E. Stuntz 383 (WTU as "*A. solitaria*"). Kitsap Co. - Bremerton, xi.1939 J. B. Flett *s.n.* (MICH as "*A. chlorinosma*"). Kittitas Co. - Cle Elum-Roslyn area, 29.x.1958 D. E. Stuntz 10787 (WTU as "*A. solitaria*"); Lake Kachess, 5.x.1986 foray participant [Joseph F. Ammirati 9318] (WTU); Keechelus Lake, "Divis"[Davis?] Pt., 7.5 km E of Keechelus Dam, 27.ix.1969 D. E. Stuntz 15546 (WTU as "*A. solitaria*"). Pacific Co. - near Grayland, 11.xi.1990 Veronica Williams *s.n.* (WTU). Pierce Co. - Mt. Ranier Nat. Pk., Tahoma Creek Rd., 15.x.1984 E. Farwell 6018 (F 1060248). Skamania Co. - Gifford Pinchot Nat. For. (GPNF), Little Soda Springs, 18.x.1987 Ron Ostrem *s.n.* [Lindgren 107] (RET); GPNF, Paradise Creek Campground, 14.xi.1987 J. E. Lindgren 110 (RET); GPNF, Trout Creek on Pacific Crest Trail, 14.xi.1987 J. E. Lindgren 114 (RET); GPNF, Wind River [formerly Hemlock] Ranger Station, 27.x.1957 R. Brooks *s.n.* (MICH). Snohomish Co. - woods S of Edmonds, 9.x.1934 D. E. Stuntz 182 (WTU as "*A. solitaria*"); S of Meadowdale, 21.x.1934 D. E. Stuntz 198A (WTU as "*A. solitaria*"). Spokane Co. - N end of Newman Lake, 5.x.1976 R. Boynton *s.n.* (WTU as "*A. solitaria*"). Thurston Co. - Millersylvania St. Pk., 13.xi.1971 D. E. Stuntz 17008 (WTU as "*A. solitaria*"); Olympia, 24.ix.1948 McKenny *s.n.* [A. H. Smith 31826] (MICH as "*A. chlorinosma*"), xi.1958 D. E. Stuntz & L. Brady *s.n.* (WTU). No county/locale cited - 15.x.1978 participant in Puget Sound Mycological Society show [Stuntz 20485] (WTU); xi.1982 poisoning victim [Stuntz 21823] (WTU).

DISCUSSION

This striking mushroom is conspicuous because of its often robust stature, the frequently extensively radicating bulb, and its stark whiteness when young. As *A. smithiana* matures, the delicate, floccose, universal veil can be washed off by rain or, in hot, dry weather, change to flat tan warts. This variation has led to misidentification and much confusion about this species. Often little or no trace of partial or universal veil is present on mature specimens. Such specimens may not be recognized by a collector as belonging to *Amanita*.

There is increasing danger of mistaken identity on the part of ill-informed collectors attracted by the current high prices for "*matsutake*" and increasing pothunter interest in *Tricholoma magnivelare* (Peck) Redhead [=*Tricholoma ponderosum* (Peck) Sing.≡*Armillaria ponderosa* (Peck) Sacc.]. *Amanita smithiana* is common in southern British Columbia, Washington, Oregon, and northern California; it occurs, at least occasionally, in southern California, Idaho, and New Mexico. Particularly because it appears to be poisonous, it should be more widely and completely known.

The literature often ascribes a strong odor to *A. smithiana*. It is the impression of Lindgren (who has collected the species frequently) that the presence of a strong odor is associated with the aging or decay of the basidiocarp. (Decay is usually noticeable first at the base of the bulb.) Her field notes indicate that some fresh, sporulating specimens were still odorless four days after collection—even when longitudinally sectioned. Further, in our examination of many collections made by Drs. C. H. Kauffman (MICH), A. H. Smith (MICH), D. E. Stuntz (WTU), and H. D. Thiers (SFSU) and by the correspondents of Dr. Smith (MICH), we found a number of cases in which the collector noted that the specimens had no odor when fresh.

Spores of immature basidiocarps may have an average Q equal to or greater than the average Q seen in mature ones. The second highest average Q noted (1.84) was from Breckon 660 which had very few mature basidia. It should also be noted that Breckon 660 may be abnormal because of its having been collected near the apparent southern extreme (Santa Cruz Co., Calif.) of what appears to be the main body of the range of *A. smithiana*. The highest value of average Q noted was from Breckon 221, a depauperate specimen, again from Santa Cruz Co. The lowest value of average Q noted was found in Thiers 38316 the lamellae of which were extensively attacked by a mold. Because very few collections included spore prints, only spores on lamellae were measured for the sake of consistency. In all cases, a portion from the mid-region of a lamella was used.

It is noteworthy that the two collections made at considerable distance from all the others (Santa Barbara Co., Calif., and New Mexico collections) were collected after rain and had spores with average Q of 1.56 and 1.41 respectively. Specimens of the Santa Barbara Co. collection are somewhat to very contorted, and one seems to lack lamellae under part of the pileus.

We ran across a small number of collections of *A. silvicola* C. H. Kauffm. misdetermined as *A. smithiana*. We find that macrochemical spot tests can be used to distinguish the two taxa. Phenoloxidase spot tests were carried out by Lindgren on Lindgren 91-50, on an additional collection of *A. smithiana*, and on three collections of *A. silvicola*. The reactions reported above for *A. smithiana* were seen in both tests of that species. The response in all tests of *A. silvicola* (for both laccase and tyrosinase) was negative. Since paracresol and syringaldazine are easily carried into the field, the application of either reagent to a longitudinal section of a basidiocarp provides a quick chemical test that will distinguish between these two white taxa. In the laboratory, the lack of basidial clamps, the lack of chains of inflated cells in the universal veil remnants left on the pileus, and smaller spores with higher average Q aid in distinguishing *A. silvicola* from *A. smithiana* (Bas, 1969).

Ammirati *et al.* (1985) state that no poisonings by *A. smithiana* were known to them at the time of writing, but that the matter is made more complex by the number of difficult to diagnose (and still in many cases undescribed) *Amanita* taxa in North America. The North American Mycological Association (NAMA) Poisoning Registry contains records of three poisonings attributed to *A. smithiana* prior to 1989. (Cochran, 1989; Lampe, 1989).

The first two reported cases involved ingestion of the mushroom as food—cases 0840.0034 (from 1976) and 0860.0136 (undated, but believed to have occurred in 1982). The symptoms noted in these cases included nausea, abdominal discomfort, malaise, nervousness, anxiety, and ''fullness.'' In 0840.0034 a 10 hour and 45 minute delay was noted before the onset of symptoms. There is no precise data about a delay in the second case, but the NAMA record says that the victim had been eating the mushroom raw while working as a truck driver ''during the week'' which implies that there had been a considerable delay since the earliest ingestion. Kidney failure was not involved in either case.

The diagnosis of the mushroom in case 0860.0136 was ''*Amanita smithiana* or other *Lepidella*.'' We found a voucher specimen (Stuntz 21833 in WTU) from a 1982 poisoning. Dr. Ammirati, WTU, informed us that the case in question was 0860.0136. Our examination of the voucher material indicates that it consists entirely of ''button'' specimens of *A. smithiana.*

In addition there is a case recorded by the Toxicology Committee of the Oregon Mycological Society. The poisoning occurred on 5 October 1982, in the area of The Dalles, Oregon. Two and one half caps of a large, white mushroom were ingested for food. After a delay period of 8 hours, nausea and excessive vomiting set in. Eventually kidney and liver functions failed. While liver function was restored, the last notes on the case indicate that the prognosis was for a requirement of kidney dialysis for a period of unknown duration. The man identified the mushroom as lacking both an annulus and a limbate volva. He (somewhat contradictorily) selected a picture of *Amanita brunnescens* as being what he had eaten. The man's father (more knowledgable about mushrooms) identified the meal as ''*Armillaria ponderosa*''. Several persons examined the decaying remnants of the collection and found spores consistent with *A. smithiana*, but a little small. None of the material survived for us to review.

Information about a 1988 case was recorded by Dr. Robert J. Bandoni, Department of Botany, The University of British Columbia, Vancouver in a letter to Dr. Ammirati who kindly made this letter available to us.

In early October of 1988, a man, who lived in the town of Sechelt northwest of Vancouver and who had some familiarity with wild mushrooms, collected and ate what he took to be *Tricholoma magnivelare.* About four hours after ingestion, abdominal pains and vomiting developed. At this point a doctor examined him, but discharged him (reason unknown). Vomiting and nausea continued for three days. The victim made his way to Vancouver where he was hospitalized. Early on in his hospitalization, renal failure was noted. The patient recovered and was discharged from the hospital. The uneaten portion of the victim's mushroom collection was salvaged in fairly good condition except that the pieces had been scrubbed and trimmed in preparation for cooking; the material was deposited in WTU (McFarlane collection). We have examined it as part of the present study; and we affirm its determination as *A. smithiana.*

We report an additional case: On 22 October 1990, a 55-year-old, male immigrant from Laos ate three basidiocarps of *A. smithiana* around 7:00 p.m. in a soup. (At least one other family member had a small amount of the soup, but never suffered any symptoms of poisoning.) The next morning at 5:30 a.m. (note the 10.5 hour delay, similar to some earlier cases), he awoke and began vomiting. He also suffered diarrhea, sweating, and dizziness. Upon first examination at the hospital, the patient showed a slightly elevated temperature and an unusual urine pH of 9. Between 23 October and 24 October the patient became oliguric and suffered acute renal failure. Doctors treating the victim considered the possibility of orellanine poisoning. Four days after ingestion, there was no sign of liver damage, but the kidneys showed little function. The patient was placed on dialysis periodically after 25 October. The patient recovered slowly and was released from the hospital on 31 October 1990 with kidney function largely restored.

Communication with the patient required a translator. In attempts to get the victim to identify the mushroom involved, the patient was shown color illustrations in various books and selected a picture of a large, white, European species of *Agaricus* referring to it as "the King". The identification of the toxic mushroom was made possible after the man's relatives gathered a bag of mushrooms (including another specimen of *A. smithiana*) at the original collecting site. The victim selected the *A. smithiana* specimen from the bag indicating that this was the sort he had eaten. A laboratory report indicated that there was orellanine in the man's body fluids. Despite this finding, we emphasize that the patient and his relatives produced evidence of ingestion only of *A. smithiana* and *not* of a small, nonwhite, *Cortinarius*.

In summary, there has been at least one poisoning attributed to *A. smithiana* in each of the following years: 1976, 1982 (2), 1988, and 1990—for a total of at least five cases. A possible sixth case was reported in 1990, but we lack information on it. Onset of symptoms was delayed for 4 hours (one case), 8 hours (one case), or more than 10 hours (two—possibly three—cases). Kidney failure occurred in three cases; of these, one case also included liver failure. Kidney failure was reversible in cases in which the liver did not fail also. In the latter, liver function was restored, but kidney function was not. A delay of more than 10 hours before onset of symptoms was noted both in one case that involved kidney failure and in one that did not.

From the above cited cases *A. smithiana* must be considered suspect; but a definitive statement concerning its toxic properties still cannot be made. At the time of this writing, several of the collections we examined from WTU (in particular, the very large collection, Lindgren 91-55) had been forwarded to Dr. M. Moser and his colleagues, Institut für Mikrobiologie, Leopold-Franzens-Universität Innsbruck, Austria, for chemical and toxicological analysis. Preliminary results (M. Moser, pers. corresp.) indicate the presence of one or more compounds toxic to renal epithelial cells.

Chemical analyses of *A. solitaria sensu* Stuntz originated with studies by Benedict *et al.* (1966) who reported the absence of ibotenic acid and muscimol and the presence of 2 compounds which demonstrated some similarity to isoxazole derivatives "in their chromatographic behavior and color reactions (yellow changing to reddish purple) with ninhydrin." Chilton *et al.* (1968) identified the one of these compounds with highest concentration in the basidiocarp to be 2(S)-amino-4,5-hexadienoic acid. Chilton & Tsou (1972) identified the second compound as a chloro amino acid—*trans*-2-amino-5-chloro-4-hexenoic acid. In the same study, Chilton & Tsou demonstrated a level of chloride ion concentration in *A. solitaria sensu* Stuntz that was significantly higher than that found in other lichens and fungi tested. Stuntz 17008 is annotated "half to Chilton". Since this is the only material in WTU that is demonstrably a voucher for the Chilton & Tsou study, it seems probable that the 1971 collection or collections cited in the table of Chloride ion concentrations (Chilton & Tsou, 1972: 2855, Tab. 2) included a portion of Stuntz 17008.

Chilton *et al.* (1973) examined possible metabolic transformations of the two compounds and found that the first discovered compound is toxic to guinea pigs in doses of 33 mg/kg body weight and that doses of 100 mg/kg are fatal to those animals:

> ...two hours after the test animals had received 100 mg/kg of synthetic allenic

> norleucine [by intraperitoneal injection], the following unequivocal symptoms were noted: a decrease in respiratory rate and depth, skin blanching and hypothermia. These symptoms progressively worsened until death occurred 25-40 hours later. Other symptoms, listed in order of appearance were: [abnormal respiratory sounds, retraction of eyes into their sockets, erection of hair, absence of the sense of pain, convulsions (either persistent contraction of muscles or alternating contraction and relaxation) caused by handling of the animal], the loss of righting and corneal reflexes. Although transient diarrhea was seen in only one of these animals, 34 - 40 g of body weight were lost prior to death. On necropsy, the hearts were found stopped in systole, the kidneys blanched and the liver tissue more friable. Hemorrhagic areas were in the lungs, but not elsewhere.

In a later study of 35 species of *Amanita*, Chilton & Ott (1976) found the two compounds only in *A. smithiana.* Chilton *et al.* (1973) recommended against ingestion of *A. solitaria sensu* Stuntz despite their observation that the toxic 2-amino-4,5-hexadienoic acid was present in the mushroom in relatively low concentration (about 0.1% fresh weight) and, therefore, that the fungus was unlikely to be ''acutely toxic to man after a single ingestion.''

Japanese reports of 2-amino-4,5-hexadienoic acid's occurring in two *Amanita* species (*A. pseudoporphyria* Hongo and *A. neoovoidea* Hongo) have been made by Hatanaka (1975), Hatanaka & Kawakami (1980), and Hatanaka *et al.* (1985). It is notable that *A. neoovoidea* has been considered edible in the past in Japan (Hongo, 1975; Shimizu, 1988). Tulloss has recently received material assignable to *A. neoovoidea* collected in Nepal by Mr. Hemanta Ram Bhandary, University of Tennessee, Knoxville. Mr. Bhandary reports that *A. neoovoidea* is eaten in Nepal (Tulloss *et al.*, 1992). The evidence from Japan and Nepal raises the question as to whether there is a method of preparation that eliminates the danger of the compound in question. Dr. T. Hongo very kindly provided us with an English synopsis of Mr. D. Shimizu's discussion of *A. neoovoidea* edibility. Shimizu (1988) reports that members of the Sendai amateur mycological club experimented with *A. neoovoidea* and found that they had no negative reactions. They concluded that the mushroom was good in sukiyaki, fried, or broiled. Mr. Shimizu reports no special treatment of the fungus prior to cooking. Dr. Hongo's synopsis closes with Shimizu's suggestion that the mushroom not be eaten in excess.

Given the fact that *A. smithiana* has been considered a possible cause in a number of poisonings in the last 15 years some of which were quite severe and given the information available about *A. neoovoidea*, the possibility should be considered that either

1. the poison or poisons in *A. smithiana* consists of one or more compounds not limited to the free amino acid studied by Chilton *et al.* or
2. the supposedly identical compounds in *A. smithiana* and *A. neoovoidea* differ.

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CONTRIBUTIONS TO OUR KNOWLEDGE OF APLOSPORELLA

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Four new species of *Aplosporella* are described and illustrated. *A. capparidis* Died. is a new record for India. In all thirteen new combinations of the genus are proposed.

The genus *Aplosporella* was erected by Spegazzni in 1880 (*Ann. Soc. Cienc. Arg.* 10 : 157). Petrak and Sydow (1927) recognised eighty species of the genus. Sutton (1980) recognised *Pleosphaeropsis* as a synonym of *Aplosporella*. However, Petrak and Sydow (1927) reduced *Pleosphaeropsis* to subgeneric rank within *Haplosporella*. Pandey (1990) has reviewed the taxonomic position of *Haplosporella* and has accepted *Pleosphaeropsis* as a synonym of *Aplosporella*.

Five species of *Aplosporella* are known from India viz., *A. aristolochiae* on *Aristolochia brasiliensis*, *A. memeycyli* on *Memecylon edule* and *A. oleae-dioicae* on *Olea dioica* (Subhedar and Rao, 1979). *Aplosporella embeliae* on *Embelia robusta* (Sharma, 1982) and *A. beaumontiana* (Ahmad, 1962; Mathur, 1970).

Ahmad and Mundkur (1949) reported four new species of the genus *Pleosphaeropsis* viz., *P. bambucina* Mundk. and Ahmad on *Bambusa* sp., *P. ahmadii* Mundk. on *Dasmia extensa* and *Pentatropsis cynanchoides*, *P.*

nerii Ahmad and Mundk. on *Nerium odorum* and *P. acaciae* Ahmad and Mundk. on *Acacia* sp. whereas, Tilak and Kulkarni (1969) added another species *P. aurangabadensis* on *Typha angustata* from Aurangabad, Maharashtra. Later, Chona and Munjal (1950) created another six new species of *Pleosphaeropsis* viz., *P. crotonis* on *Croton* sp., *P. anonae* on *Anona squamosa, P. cryptostegiae* on *Cryptostegia grandiflora, P. fici* on *Ficus* sp., *P. psidii* on *Psidium guajava* and *P. thevetiae* on *Thevetia nerifolia* besides, *P. dalbergiae* was recorded on an additional host *Dolichos lablab* as a new host record.

In the present studies the authors propose to redesignate these thirteen species of the genus *Pleosphaeropsis* to *Aplosporella* as combination novum.

1. *Aplosporella indica* Agarwal, Chowdhry and Sarbhoy, Sp. nov. (Fig. 1 A, B, C)

Conidiomata stromatica, valsoidea, gregaria, singularia, innota, postea erumpentia, 400-800 x 250-500 μm, superficialia, externe atrobrunnea, interiore fusca, multilocularia, loculi 3-7 saepe confluentibus, ostiolata, ostiolae praestantes, coniunctae ad ostiolaren regionem in singule fuscobrunneo rotundo. Cellulae conidiogenae determinatae, discretae, filiformiae, hyalinae. Conidia oblonga vel ovata, primum hyalina, postea castaneo-brunnea, pariete crasso, unicellulata, 15-20 x 10-15 μm. Paraphyses hyalinae, filiformis cum apice inflato, flexuosae et senescentes collapsae aetas.

1. *Aplosporella indica* Agarwal, Chowdhry and Sarbhoy, Sp. nov. (Fig. 1 A, B, C)

Conidiomata stromatic, valsoid, gregarious, single or aggregated, innate, later erumpent, 400-800 x 250-500 μm in diameter, superficial, exposed part blackish brown, peripheral region dark brown and carbonaceous in nature, interior dark coloured, multilocular, locules 3-7 in number, often

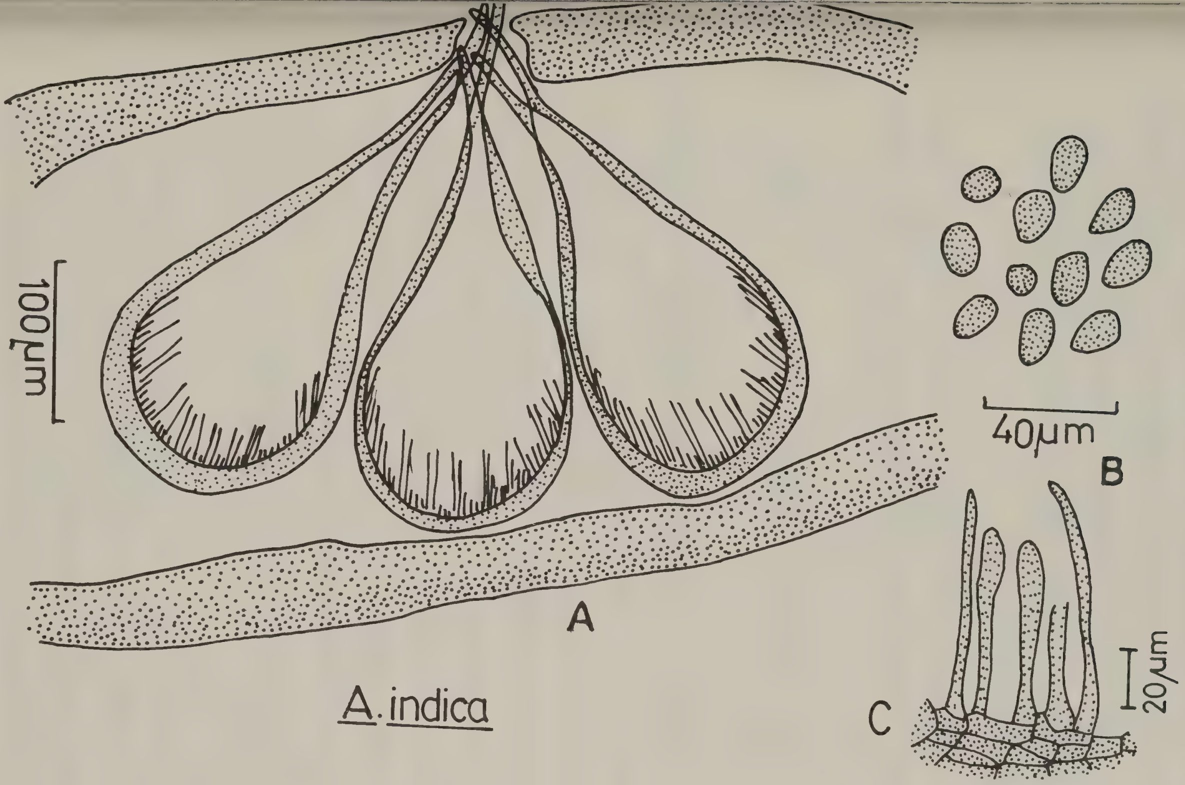
100µm
A
A. indica
40µm
B
20µm
C

Fig. 1. *Aplosporella indica,* A. Conidiomata, B. Conidia, C. Conidiogenous cells with paraphyses.

aggregated, ostiolate, ostiole prominent, central, circular, round, converging into common area of dehiscence. Conidiogenous cells determinate, discrete and hyaline. Conidia hyaline when young, later becoming chestnut brown, thick walled, verrucose, oblong to oval, aseptate, 15-20 x 10-15 μm in size. Paraphyses hyaline, filiform with swollen apices, flexuous and degenerate with age.

On fallen dead twigs of *Prunus domestica* L. (Rosaceae), Rohtak, Haryana; D.K. Agarwal, 3.1.1975, H.C.I.O. 37141 (Holotype), I.A.R.I., New Delhi, India.

2. *A. morii* Agarwal, Chowdhry and Sarbhoy, Sp. nov.
(Fig. 2 A, B, C)

Conidiomata stromatica, valsoidea, subepidermoidea, globosa vel subglobosa, 100-150 μm, externe atrobrunnea, interiore olivaceobrunnae, multilocularia, loculis 3-6 saepa, confluentibus, ostiolatum, ostiola praestantes, ad ostiolaren regiorem in singule fuscobrunneo rotundo. Cellulae conidiogenae determinatae, discretae, hyalinae, filiformes. Conidia unicellulina crasso oblonga vel ovatoa annum hyalina, postea castaneobrunnea, verrucosa, 10-25 x 12-20 μm. Paraphyses hyalinae, filiformes, apices inflato, flexuosae, senescentis collapsae.

2. *A. morii* Agarwal, Chowdhry and Sarbhoy, Sp. nov.
(Fig. 2 A, B, C)

Conidiomata stromatic, valsoid, subepidermal, globose to subglobose, 100-150 μm in diam., exposed part blackish brown at peripheral regions and olive brown in the interior; multilocular, locules 3-6 in number, often aggregated. Conidioma ostiolate; ostiole single, central, circular with dark brown rims. Conidiogenous cells determinate, discrete,

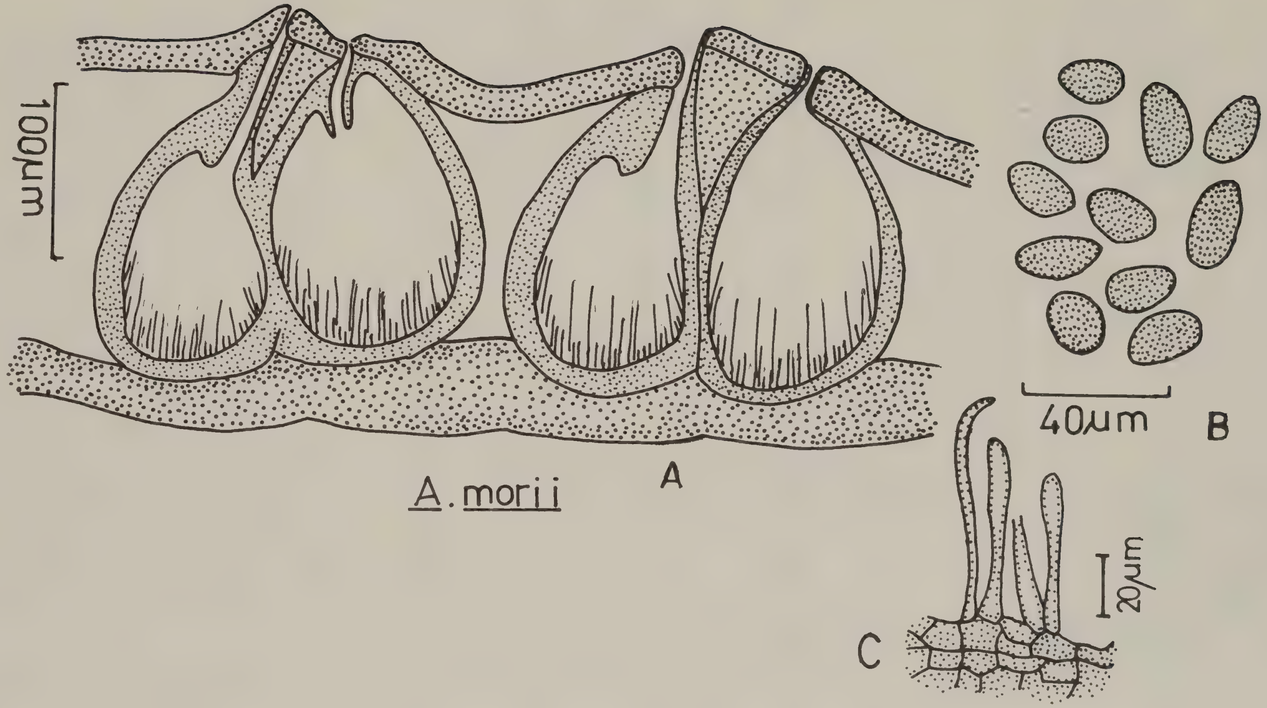
100µm
40µm
B
A
A. morii
20µm
C

Fig. 2. *Aplosporella morii*, A. Conidiomata, B. Conidia, C. Conidiogenous cells with paraphyses.

hyaline, filiform. Conidia oblong to oval, aseptate, hyaline, later becoming dark brown, thick walled, verrucose, 10-25 x 12-20 μm in size. Paraphyses hyaline, filiform, with swollen apices, smooth, flexuous, degenerating with age.

On fallen dead twigs of *Morus alba* L. (Moraceae), Rohtak, Haryana; 3.1.1975, D.K. Agarwal, H.C.I.O. 37144 (Holotype), I.A.R.I., New Delhi, India.

3. *A. sidae* Agarwal, Chowdhry and Sarbhoy, Sp. nov.
(Fig. 3 A, B, C)

Conidiomata stromatica, valsoidea vel semi-erumpentia, singularia aut aggregata, globosa, innata, postea erumpentia, multilocularia, loculi 5-10, 150-380 μm diam., externe atrobrunnea, interiore vere pallido-brunneo, ostiolata, ostiola minuta, circulari, fuscae. Cellulae conidioginae determinatae, discretae, filiformes, hyalinae. Conidia oblongo vel ovato, nonseptata, pariete crasso, verrucoso, 15-12 x 12-15 μm. Paraphyses tenues, hyalinae, flexuosae, filiformes, apice inflato cumae tas, senescentes collapsae.

3. *A. sidae* Agarwal, Chowdhry and Sarbhoy, Sp. nov.
(Fig. 3 A, B, C)

Conidiomata stromatic, valsoid, semi-erumpent in the host tissues, solitary or aggregated, gregarious, globose, innate, later erumpent, exposed part blackish brown, 150-380 μm in diam., ostiolate, multilocular, locules 5-10 with peripheral region dark brown, interior light coloured, ostioles circular, dark coloured. Conidiogenous cells determinate, discrete, filiform, hyaline. Conidia oblong to oval, aseptate, hyaline when young, later becoming chestnut brown, thick walled, verrucose, 10-15 x 12-15 μm.

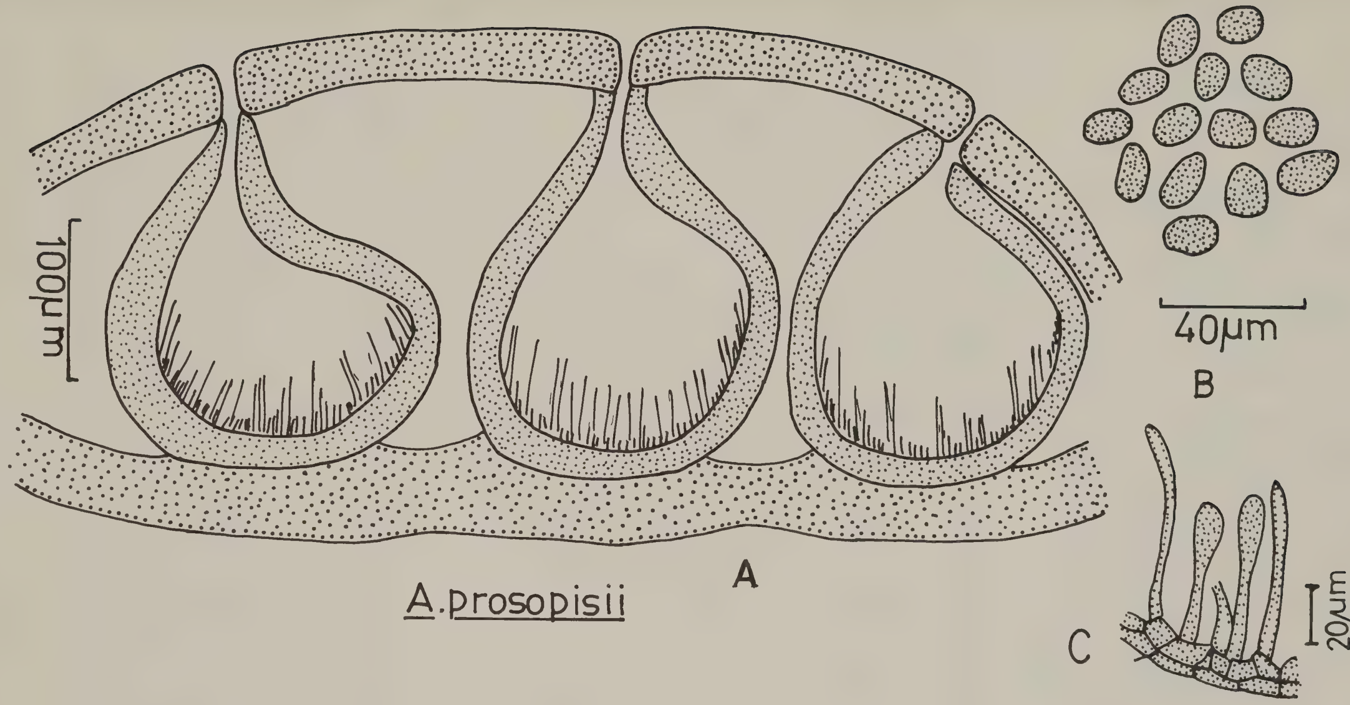
100µm
40µm
B
A
A.prosopisii
C
20µm

Fig. 3. *Aplosporella prosopisii,* A. Conidiomata, B. Conidia, C. Conidiogenous cells with paraphyses.

Paraphyses thin, hyaline, flexuous, filiform, smooth, swollen at the apices; disintegrating with age.

On fallen dead twigs of *Sida spinosa* L. (Malvaceae), Rohtak, Haryana; 19.1.1975, D.K. Agarwal, H.C.I.O. 37142 (Holotype), I.A.R.I., New Delhi, India.

4. *A. prosopisii* Agarwal, Chowdhry and Sarbhoy, Sp. nov.
(Fig. 4 A, B, C)

Conidiomata stromatica, innata, valsoidea, erumpentia, frequentes aggregata, externe partebrunnea vel atra, carbonacea, subglobosa vel ovoidea, 200-400 µm in diam., ostiolata, ostiola minuta et circularis multilocularia, loculi 4-7 distincta cum tunica, circumdata zona parenchymatica, atrobrunneo, interne strato pallido-brunneo. Cellulae conidiogenae holoblasticae, determinatae, hyalinae, filiformes, laeves. Conidia oblonga vel ovoidea, non septata hyalina, 10-20 x 10-16 µm, matura castano brunnea. Paraphyses flexuosae, hyalinae, filiformes, apice tumidae, senescentes collapsum.

4. *A. prosopisii* Agarwal, Chowdhry and Sarbhoy, Sp. nov.
(Fig. 4 A, B, C)

Conidiomata stromatic, innate, valsoid, later erumpent, often aggregated, exposed part blackish brown, carbonaceous, multilocular with 4-7 locules in number having distinct walls, peripheral region dark brown, interior light coloured, subglobose to oval in appearence, 200-400 µm in diam. Ostiolate; ostiole small, central, and circular. Conidiogenous cells holoblastic, determinate, hyaline, filiform and smooth. Conidia when young embedded in mucous, aseptate, hyaline, oblong to oval,

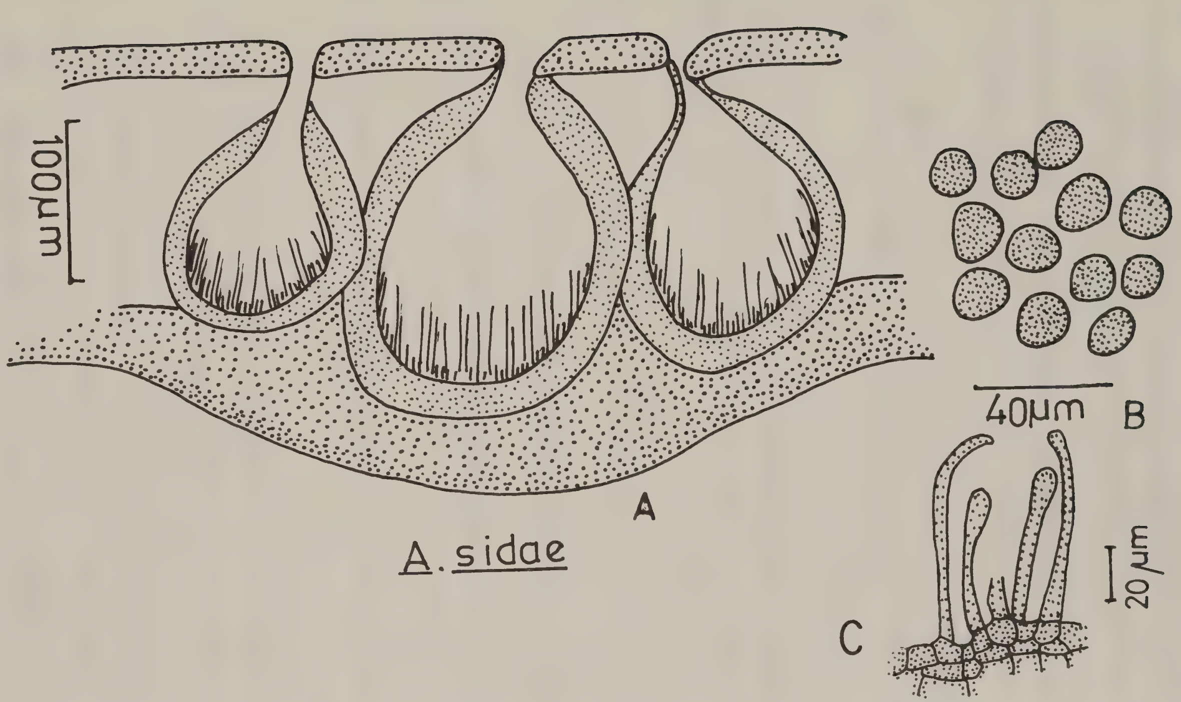
100µm
A
A. sidae
40µm
B
C
20µm

Fig. 4. *Aplosporella sidae*, A. Conidiomata, B. Conidia, C. Conidiogenous cells with paraphyses.

10-20 x 10-16 µm in size, after maturity turn to chesnut brown. Paraphyses flexuous, hyaline, filiform, swollen at tips, degenerating with age.

On fallen dead branches of *Prosopis spicigera* L. (Leguminosae), Rohtak, Haryana; 18.1.1975, D.K. Agarwal, H.C.I.O. 37143 (Holotype), I.A.R.I., New Delhi; India.

5. ***A. capparidis*** **Died.** ***Ann. Mycol.*** **14 : 177-200, 1926;** ***Sacc. Syll. Fung.*** **25 : 251, 1926-1927.**

On dead twigs of *Capparis sepiaria* L. (Capparidaceae), Rohtak, Haryana; 18.1.1975, D.K. Agarwal, H.C.I.O. 37145, I.A.R.I., New Delhi; India.

This constitutes a new record of the fungus from India.

The following new combinations are proposed :

1. *A. anonae* (Chona & Munjal) Agarwal, Chowdhry and Sarbhoy, Comb. nov.

   ≡ *Pleosphaeropsis anonae* Chona & Munjal (*Indian Phytopath.*, **3** : 108-109, 1950).

   On dead twigs of *Anona squamosa* L., U.B. Singh, 8 Aug., 1933, Kumaon, U.P.; H.C.I.O. 19746 (Type), I.A.R.I., New Delhi; India.

2. *A. crotonis* (Chona & Munjal) Agarwal, Chowdhry and Sarbhoy, Comb. nov.

   ≡ *Pleosphaeropsis crotonis* Chona & Munjal. (*Indian Phytopath.*, **3** : 109, 1950).

On dead twigs of *Croton* sp., Aug. 1916, Pusa, Bihar; L.S. Mony, H.C.I.O. 19740 (Type), I.A.R.I., New Delhi; India.

3. *A. cryptostegiae* (Chona & Munjal) Agarwal, Chowdhry and Sarbhoy, Comb. nov.

  ≡ *Pleosphaeropsis cryptostegiae* Chona & Munjal. (*Indian Phytopath.*, **3** : 109-110, 1950).

On dead twigs of *Cryptostegia grandiflora* Br., Lahore, 21.7.1939; Director, Bot. Deptt., Pb. Univ., H.C.I.O. 19749 (Type), I.A.R.I., New Delhi; India.

4. *A. dalbergiae* (Died. ex Petr. & Syd.) Agarwal, Chowdhry and Sarbhoy, Comb. nov.

  ≡ *Pleosphaeropsis dalbergiae* Died. (*Ann. Mycol.*, **14** : 203, 1916; Sacc., *Syll. Fung.*, **25** : 250, 1931; Butler & Bisby. *Sci. Mongr. Coun. Agr. Res.* India, **1** : 162, 1931; Chona & Munjal, *Indian Phytopath.*, **1** : 110, 1950.

  ≡ *Pleosphaeropsis dalbergiae* (Died.) Petr. & Syd. (*Regni. Veg. Beih.*, **42** : 105, 1927).

On dead twigs of *Dalbergia sissoo* L., I.A.R.I., New Delhi; H.C.I.O. 19793 (Type); Pusa, Bihar; 26.4.1911, J.F. Dastur, H.C.I.O. 1778; on *Dolichos lablab* L., I.A.R.I., New Delhi; India, Aug., 1948; H.C.I.O. 19748.

5. *A. fici* (Chona & Munjal), Agarwal, Chowdhry and Sarbhoy, Comb. nov.

  ≡ *Pleosphaeropsis fici* Chona & Munjal. (*Indian Phytopath.*, **3** : 110-111, 1950).

On dead twigs of *Ficus* sp., Ganeshkhind, Poona, M.S.; Aug. 1921, S.L. Ajrekar, H.C.I.O. 19749 (Type), I.A.R.I., New Delhi; India.

6. *A. psidii* (Chona & Munjal) Agarwal, Chowdhry and Sarbhoy, Comb. nov.

≡ *Pleosphaeropsis psidii* Chona & Munjal. (*Indian Phytopath.*, **3** : 111, 1950).

On dead twigs of *Psidium guajava* L., S.L. Ajrekar, Ganeshkhind, Poona, M.S.; Aug. 1921, H.C.I.O. 19741 (Type), I.A.R.I., New Delhi; India.

7. *A. thevetiae* (Chona & Munjal) Agarwal, Chowdhry and Sarbhoy, Comb. nov.

≡ *Pleosphaeropsis thevetiae* Chona & Munjal. (*Indian Phytopath.*, **3** : 111-112, 1950).

On dead twigs of *Thevetia nerifolia* Juss., I.A.R.I., New Delhi; Jan., 1950, G. Lal, H.C.I.O. 19745 (Type), I.A.R.I., New Delhi; India.

8. *A. gossypii* (Died. ex Petr. & Syd.) Agarwal, Chowdhry and Sarbhoy, Comb. nov.

≡ *Pleosphaeropsis gossypii* Died., Sacc., *Syll. Fung.*, **25** : 250, 1931; Munjal & Chona, *Indian Phytopath.*, **3** : 112, 1950.

≡ *Pleosphaeropsis gossypii* (Died.) Petr. & Syd. (*Regni. Veg. Beih.*, **42** : 106, 1927).

On dead branches of *Gossypium* sp., Pusa, Bihar; H.C.I.O. 1777, Ludhiana, Pb.; 28.12.1941, S. Ahmad, H.C.I.O. 10630, I.A.R.I., New Delhi; India.

9. *A. bambusina* (Mundk. & Ahmad) Agarwal, Chowdhry and Sarbhoy, Comb. nov.

≡ *Pleosphaeropsis bambusina* Mundk. & Ahmad (*Mycol. Pap.*, 18 : 11, 1946).

On dead poles of *Bambusa* sp., Shahwea, Lahore; 16.8.1944; S. Ahmad, H.C.I.O. 10637 (Type), I.A.R.I., New Delhi; India.

10. *A. ahmadii* (Mundk.) Agarwal, Chowdhry and Sarbhoy, Comb. nov.

≡ *Pleosphaeropsis ahmadii* Mundk. (*Mycol. Pap.*, 18 : 11, 1946).

On dead branches of *Dasmia extensa* L., Rohtak, Pb.; 6.12.1944; S. Ahmad, H.C.I.O. 10641 (Type); On dead twigs of *Pentatropsis cynanchoides* Roxb., Rohtak, Pb.; 20.11.1944, S. Ahmad, H.C.I.O. 10639 (Type), I.A.R.I., New Delhi; India.

11. *A. nerii* (Ahmad & Mundk.) Agarwal, Chowdhry and Sarbhoy, Comb. nov.

≡ *Pleosphaeropsis nerii* Ahmad & Mundk. (*Mycol. Pap.*, 18 : 12, 1946).

On dead twigs of *Nerium odorum* L., Rohtak, Pb.; 25.11.1944, S. Ahmad, H.C.I.O. 10638 (Type), I.A.R.I., New Delhi; India.

12. *A. acaciae* (Ahmad & Mundk.) Agarwal, Chowdhry and Sarbhoy, Comb. nov.

≡ *Pleosphaeropsis acaciae* Ahmad & Mundk. (*Mycol. Pap.*, 18 : 12, 1946).

On dead twigs of *Acacia farnesiana* Roxb., Ladhar, Shikhupura, Pb.; 30.8.1944, S. Ahmad, H.C.I.O. 10640, (Type), I.A.R.I., New Delhi; India.

13. *A. aurangabadensis* (Tilak & Kulkarni) Agarwal, Chowdhry and Sarbhoy, Comb. nov.

≡ *Pleosphaeropsis aurangabadensis* Tilak & Kulkarni (*Maharashtra Vigyan Mandir Patrika*, 18-19, 1969).

On dead twigs of *Typha angustata* Chaub. & Bory., Aurangabad, M.S.; 16 Aug., 1969, S.T. Tilak, H.C.I.O. 29893 (Type), I.A.R.I., New Delhi; India.

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MYCOTAXON

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PSEUDOCERCOSPORA SIEBERIANA SP.NOV. FROM INDIA

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ABSTRACT

Pseudocercospora sieberiana sp.nov. on Cassia occidentalis was described and illustrated.

A severe leaf spot disease , caused by Pseudocercospora sp. was recorded on leaves of Cassia occidentalis L. at Nagarjuna nagar, regularly from 1989 during November-February period. The disease first appears as discolouration on the upper surface of the leaf, later turns to reddish brown spots with white spore mass in the center. The same fungus was recorded on Cassia auriculata L. as sooty patches on the upper surface of the leaf. A perusal of literature shows that the fungus is similar to conidial stage of Mycosphaerella sieberiana Sivanesan discribed on Cassia siberiana (Sivanesan, 1979). In our collections the teleomorph was not observed. Since the anamorph was not given any binomial by Sivanesan, the present fungus is described here as a new species.

Pseudocercospora sieberiana Raghu Ram and Mallaiah, sp.nov. (Fig.1)

Maculae primo pallide griseae, orbicularis, usque 3 mm latae, denide redo brunneo, suborbiculares et usque 10 mm latae margine indistincto. Caespituli plerumque hypophylli, effusi, olivacei. Stroma non evolutum. Conidiophora circa 9 in fasciculo per stoma emergentia, leniter divergentia, brunnea, usque 37.5 um longa, 2-2.5 um lata. Cicatrices conidiales circa 1.5 um diam. Conidia pallide olivacea, obclavato-cylindrica, recta vel curvata, 1-5 (raro 6) septata, non constricta, 27.5-72.5 um longa, 2.5-3 um lata.

In foliis vivis Cassia occidentalis L. (Leguminosae), University campus, Nagarjuna nagar, India., Nov. 1989, IMI 344152, holotypus ; Cassia auriculata L. Leg, Univ. campus, Nagarjuna nagar, India., Nov, 1989, IMI 344153, holotypus.

Leaf spots at first appear as pale grey, circular up to 3 mm diam. later turning to reddish brown, subcircular and measure up to 10 mm wide, without any distinct margin. Sporulation mostly hypophyllous, effuse and olivaceous. Stroma not developed. Conidiophores about 12 in a fascicle emerging through a stoma, slightly divergent, brown, swollen at the extreme base and measure up to 37.5 µm long and 2-2.5 µm wide. Conidial scars about 1.5 µm in diam. Some of the old scars inconspicuous, situated on small shoulders or on very small denticles. Conidia rather pale olivaceous, obclavato-cylindric, usually slightly curved, 1-6 septate, not constricted, base obconically truncate, tip rounded, 27.5-72.5 µm X 2.5-3 µm.

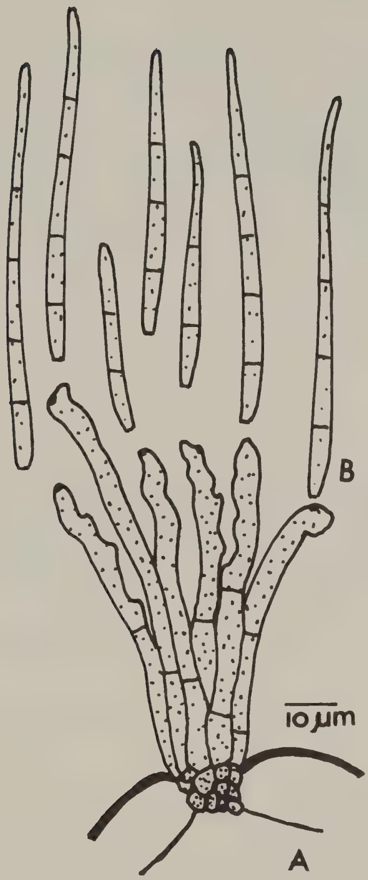

Fig.1. Pseudocercospora sieberiana: A, Fascicles of conidiophores; B, Conidia.

The present fungus differs only from that on Cassia sieberiana in having conidiophores being consistantly shorter in length and lesser in width.

The authors are thankful to Dr. B.C.Sutton, of International Mycological Institute, Kew, England., for identification of the pathogen. We are also thankful to Dr. A. Sivanesan of IMI, Kew, England, for critically going through the manuscript.

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MYCOTAXON

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JERAINUM TRIQUETRUM GEN. ET SP. NOV., A NEW HYPHOMYCETE WITH MURIFORM AND APPENDAGED CONIDIA

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A dematiaceous hyphomycete colonizing submerged decaying twigs in a freshwater stream is described and illustrated as **Jerainum triquetrum** gen. et sp. nov. It produces dark, muriform, pyramid-shaped conidia with long, hyaline radiating appendages at the tip of the corner cells and at the detached base.

The fungus described in the present paper was found sporulating on pieces of decaying twigs collected from a small freshwater stream at Gunung Jerai, Kedah, Malaysia, 1200 m a.s.l. The fungus appeared on the twigs within a week of incubation in moist chambers at 25 - 28°C and continued to sporulate for 3 - 4 weeks. The combination of characteristics shown by the fungus does not fit any known taxon. A new genus **Jerainum** is erected to accommodate it.

Jerainum gen. nov.
(Etym. after Gunung Jerai, the locality in which the fungus was isolated)

Coloniae effusae, brunnea, plerumque inconspicuae. Mycelium partim superficiale, partim in substrato immersum, ex hyphis laevis, brunneis, ramosis, septatis compositum. Conidiophora macronematosa, mononematosa, solitaria vel gregaria, erecta, recta vel flexuosa, septata, ex mycelio superficiali oriunda. Cellulae conidiogenae in conidiophoris incorporatae, terminales, monoblasticae, prolificantes percurrentes. Conidia acrogenosa, solitaria, sicca, brunnea, laevia, ellipsoidea vel obconica, muriformia, brachiis coronata cum brachio basali per separationis cicatricem statim post separationem formata. Conidiorum secessio schizolytica.

Colonies effuse, brown, mostly inconspicuous. Mycelium partly superficial, partly immersed in the substratum, consisting of smooth, brown, branched, septate hyphae. Conidiophores macronematous, mononematous, solitary or in groups, erect, straight to flexuous, septate, arising from the superficial hyphae. Conidiogenous cells incorporated in the conidiophores, terminal, monoblastic and proliferating percurrently. Conidia acrogenous, solitary, dry, brown, smooth, ellipsoidal to obconical, muriform, with appendages at the crown and at the base formed during and after conidial secession. Conidial secession schizolytic.

Jerainum triquetrum sp. nov.
(Etym. triqueter (L) = three-angled) Figs. 1 - 2

Coloniae tenuiter effusae, brunneae, plerumque inconspicuae. Mycelium partim superficiale, partim in substrato immersum, ex hyphis laevis, brunneis, ramosis, septatis, 2 - 3 µm latis compositum. Conidiophora macronematosa, mononematosa, solitaria vel gregaria, erecta, recta vel flexuosa, interdum leviter geniculata, laevia, 1 - 5 septata, brunnea, 16 - 26 µm alta, 4 - 5 µm lata. Cellulae conidiogenae in conidiophoris incorporatae, subglobosae, vel ellipsoideae, 6 - 9 µm x 5 - 6 µm, terminales. Conidia acrogenosa, solitaria, sicca, olivaceo-brunnea vel obscure rubro-brunnea, laevia, obconica, muriformia, ad basim 4 - 5 µm lata, supra autem latiora usque ad 20 - 30 µm fiunt, 22 - 32 µm alta, coronata quadribus brachiis simultaneis, 20 - 49 µm longa, 1.5 - 2 µm lata. Brachium basali eiusdem mensurae per separationis cicatricem fit post conidii liberationem. Conidiorum secessio schizolytica.

Ex ramulum putridum in flumine immersi, Gunung Jerai, Kedah, Malaysia, A. Nawawi, 27 Feb. 1988, University of Malaya Herbarium KUL 300009, holotypus.

Colonies thin, effuse, brown, mostly inconspicuous. Mycelium partly superficial, partly immersed in the substratum, consisting of smooth, brown, branched, 2 - 3 µm wide septate hyphae. Conidiophores arise as lateral branches of the vegetative hyphae, macronematous, mononematous, simple, solitary, or in groups of 2 - 3, erect, straight to flexuous, 1 - 5 septate, 16 - 26 µm high, 4 - 5 µm wide, cylindrical below, becoming somewhat beaded above. Conidiogenous cells incorporated in the conidiophores, subglobose to ellipsoidal, 6 - 9 µm long x 5 - 6 µm wide, forming a terminal conidium. Conidiogenous cells proliferate percurrently. Conidia acrogenous, solitary, dry, olivaceous brown to dark reddish brown, muriform, triangular in face view, 4 - 5 µm wide at the base, broadening to 20 - 30 µm at the top, 22 - 32 µm high, broadly ellipsoidal to doliiform with two protruding corner cells in side view, 12 - 20 µm at the widest. Viewed from above the conidium is somewhat rectangular with round accentuated corner cells each

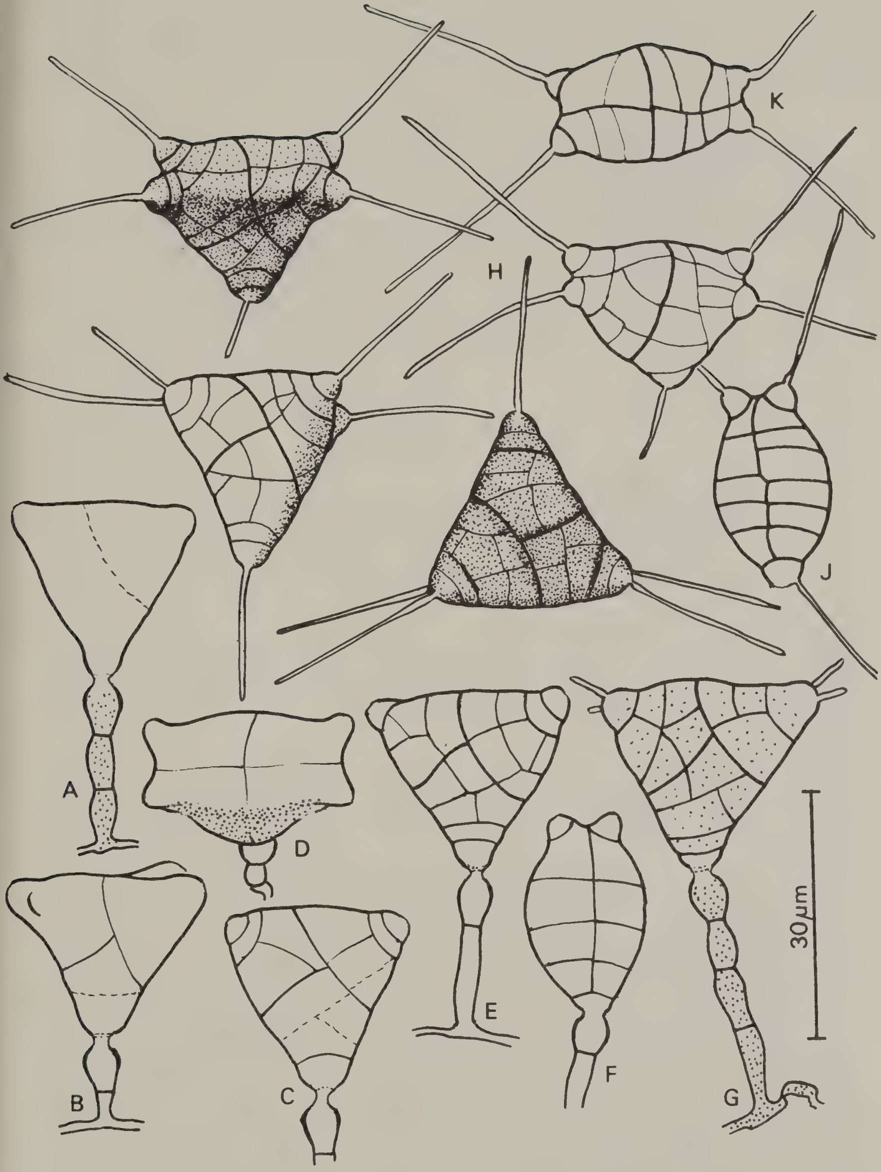

Fig 1. **Jerainum triquetrum** (A - G) Conidia at various stages arranged in developmental series as observed on decaying twigs; (H) typical conidia; (J) a conidium in side view; (K) a conidium viewed from above.

bearing a thin, simple, hyaline, non-septate appendage 20 - 49 µm long, 1.5 - 2 µm wide, formed more or less simultaneously. Basal appendage of similar length, formed just before conidial secession which is schizolytic.

Observations on conidial formation show that the conidium initials are hyaline, narrowly ellipsoidal, soon becoming obconical. An oblique septum cuts the young conidium into two. This is followed by the formation of another septum on the opposite side; the two meet in the middle resulting in a λ -shaped outline. More septa are laid down transversely and obliquely resulting in a muriform conidium with some septa appearing thicker than others. Pigmentation and thickening of the conidium wall occur soon after the first few septa are formed. This is followed by the formation of the appendages at the tip of the rounded corner cells which remain paler in colour. A basal appendage appears just before the conidium is delimited from the conidiophore.

An additional collection of **J. triquetrum** was found on submerged decaying twigs from Sarawak. Conidia are slighter broader, but otherwise the shape and pigmentation are correct for this species. Attempts to germinate the conidia of both collections were unsuccessful.

Other specimen examined: On submerged decaying twigs in moist chambers, Bako National Park, Sarawak. 15 July, 1990, A. Nawawi,

The most distinctive features of **Jerainum** are the dark, thick-walled, muriform, pyramid-shaped conidia furnished with long, hyaline, filiform appendages at the tip of the corner cells and the presence of an excentric basal appendage which is formed just before the conidium is delimited from the conidiophore and which continues to lengthen after detachment. There are no genera of hyphomycetes available to accommodate the species satisfactorily. It was at first considered for inclusion in **Pseudopetrakia** Ellis (1971). The most distinctive features of **Pseudopetrakia,** however, are the globose to subglobose muriform conidia with black, rigid, acute setae which develop coincidentally with the body of the conidium. **Chuppia** Deighton (1965) and **Monodictys** Hughes (1958) are other possibilities but in these genera the cells of the muriform conidia do not form setae. Further, their conidia are variable in morphology. There are several species of **Acrodictys** Ellis (1961) whose muriform conidia bear setae or appendages. These include **A. appendiculata** Ellis (1965) and **A. viridescens** Sutton & Alcorn (1984). Their so-called appendages, however, are mammiform, uncinate to curved

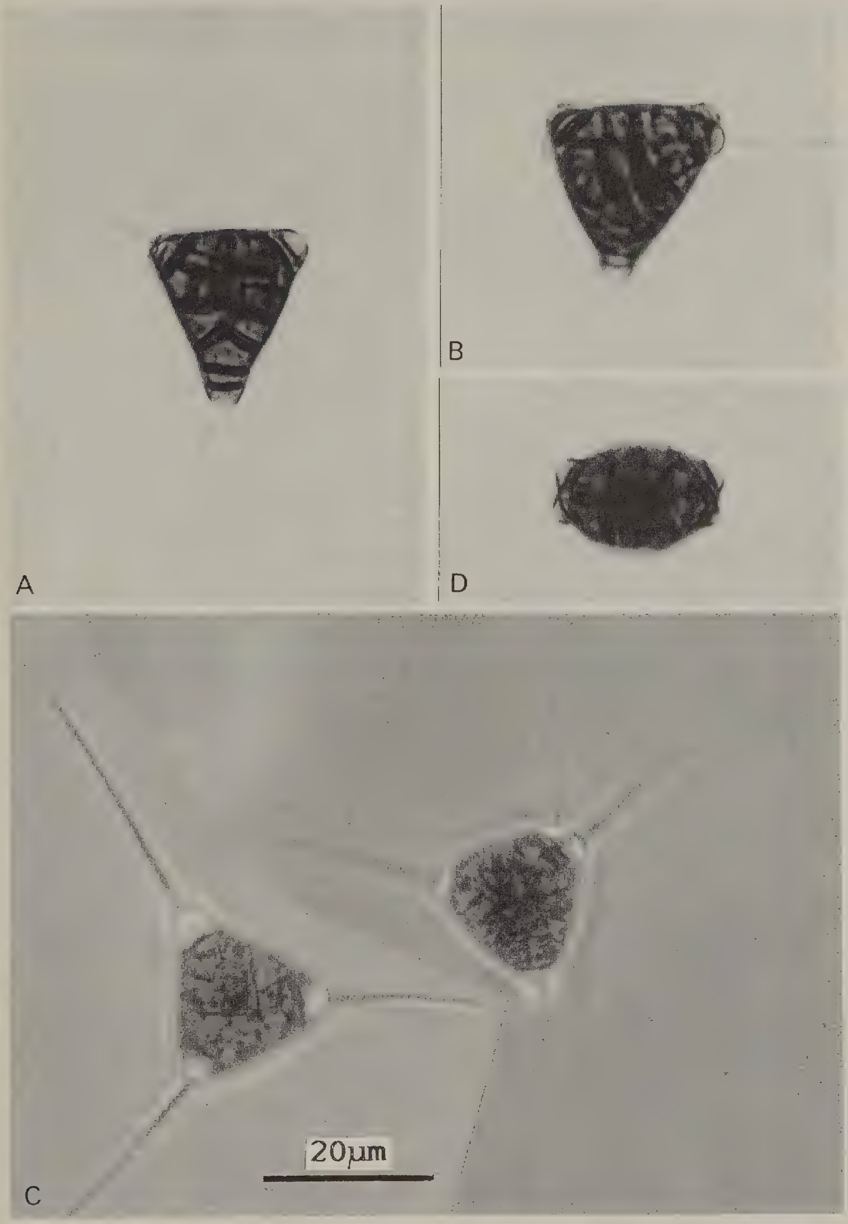

Fig. 2. **Jerainum triquetrum** (A - C) Typical conidia; (D) a conidium viewed from above.

extensions of peripheral cells of the conidium. To include the present fungus in **Acrodictys** would be stretching the generic concept of **Acrodictys.**

The conidia of **J. triquetrum** are not unlike those of **Diplocladiella tricladioides** Nawawi (1985) described from submerged decaying wood. Their conidia are dark, multicellular, pyramid-shaped or triangular in outline, and the distinct corner cells are each furnished with a long, filiform, hyaline appendage. However, no basal appendage developed after conidial detachment, and the conidia are formed on sympodially proliferating conidiophores with distinct conidial scars.

The aquatic hyphomycete **Clavariana aquatica** Nawawi apud Descals, Nawawi & Webster (1976) has obovate conidia with long, filiform appendages radiating out from the corner cells. As with **J. triquetrum** a basal appendage is present which develops just before conidial detachment. There are salient differences, however, between the two species. **C. aquatica** has hyaline, non-septate conidial body which is morphologically and ontogenically different from **J. triquetrum.**

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MYCOTAXON

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FURTHER NEW SPECIES AND NEW REPORTS OF PERTUSARIA (LICHENISED ASCOMYCOTINA) FROM AUSTRALIA

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ABSTRACT: The species *Pertusaria asperata* Archer, *Pertusaria atromaculata* Archer & Elix, *Pertusaria globospora* Archer & Elix, *Pertusaria paradoxica* Archer & Elix, *Pertusaria planaica* Archer & Elix, *Pertusaria saltuensis* Archer & Elix, *Pertusaria subplanaica* Archer, & Elix, *Pertusaria whinrayii* Archer and *Pertusaria xylophyes* Archer are described as new; *Pertusaria ceylonica* Müll.Arg., *Pertusaria lavata* Müll.Arg., *Pertusaria leucoplaca* Müll.Arg. *Pertusaria microstoma* Müll.Arg., *Pertusaria rigida* Müll.Arg.and *Pertusaria thwaitesii* Müll.Arg. are reported as new to Australia. *Pertusaria amblyogona* Müll.Arg. and *Pertusaria confluens* Müll.Arg. are reported as synonyms of *Pertusaria leioplacella* Nyl., *Pertusaria meridionalis* var. *xanthostoma* Müll.Arg. is reported as a synonym of *Pertusaria flavens* Nyl. and *Pertusaria trisperma* Müll.Arg, *Pertusaria impressula* Müll.Arg. and *Pertusaria blumeana* are reported as synonyms of *Pertusaria ceylonica* Müll.Arg.

INTRODUCTION

A number of new species in the lichen genus *Pertusaria* have recently been described from Australia (Kantvilas 1990, Archer 1991, Archer 1991a, Archer 1992) and an examination of further specimens has shown the presence of additional undescribed taxa which are reported here. Several taxa, originally described from India, Sri Lanka, Indonesia and New Zealand are reported for the first time from Australia. The sources of the specimens and the techniques used for the examination of specimens have been described previously (Archer 1991); the chemistry of the majority of the specimens examined was confirmed by liquid chromatography (Lumbsch & Elix 1985). The spore descriptions follow the nomenclature of Dibben (Dibben 1980: 10). The figures illustrate holotypes except for *Pertusaria paradoxica* which is Hafellner 19630. All type specimens cited have been seen unless noted otherwise.

Pertusaria asperata Archer sp. nov. Fig.1

Thallus albidus vel cinereo-albidus, tenuis, areolatus et rimosus, superficies subtuberculata et hebetata, isidiis et sorediis destitutus; saxicola; apothecia veruciformia, inconspicua, numerosa, dispersa, raro confluentia, plano-hemisphaerica, thallo concoloria, basibus constrictis, 0.8-1.5 mm diam.; ostiola conspicua, fusca, in verrucas singulas; sporae 8nae, irregulariter biseriatae, ellipsoideae vel subfusiformes, laeves, 112-125 μm longae, 37-50 μm latae.

Thallus lichexanthone et acidum sticticum continens.

Type: Australia, New South Wales, Myall River State Forest, on sandstone rock, by side of track near Crawford River, *ca*. 10 km W of Bulahdelah, 32°25'S, 152°06'E, alt. *ca*. 50 m, *A. Archer P188*, 20.vi.1991; NSW-holotype.

Thallus off-white to pale greyish white, thin, areolate and cracked, surface subtuberculate and dull, lacking isidia and soredia, saxicolous; *apothecia* verruciform, concolorous with the thallus, inconspicuous on the rough substrate, numerous, scattered, rarely confluent, flattened hemispherical, concave above, constricted at the base, 0.8-1,5 mm diam.; ostioles conspicuous, dark brown, 1 per verruca; *spores* 8/ascus, ellipsoid to subfusiform,, smooth, irregularly biseriate, 112-125 μm long, 37-50 μm wide.
Chemistry: K-, KC-, C-, Pd-; lichexanthone and stictic acid as major compounds.

P. asperata resembles *P. petrophyes* Knight but is distinguished from that species by the spore size and chemistry. These characters also distinguish *P. asperata* from other eight-spored, saxicolous *Pertusaria* taxa found in Australia. The new species superficially resembles the Brazilian saxicolous *Pertusaria rudecta* Müll.Arg. (Müller 1884) [holotype: Brazil, near Apiahy, Puiggari 1470, 1882 (G)] but this species has four spores per ascus, lacks lichexanthone and contains norstictic acid.
P. asperata is known only from the type specimen where it occurs with *Rinodina* and *Lecidea sens. lat.* species.

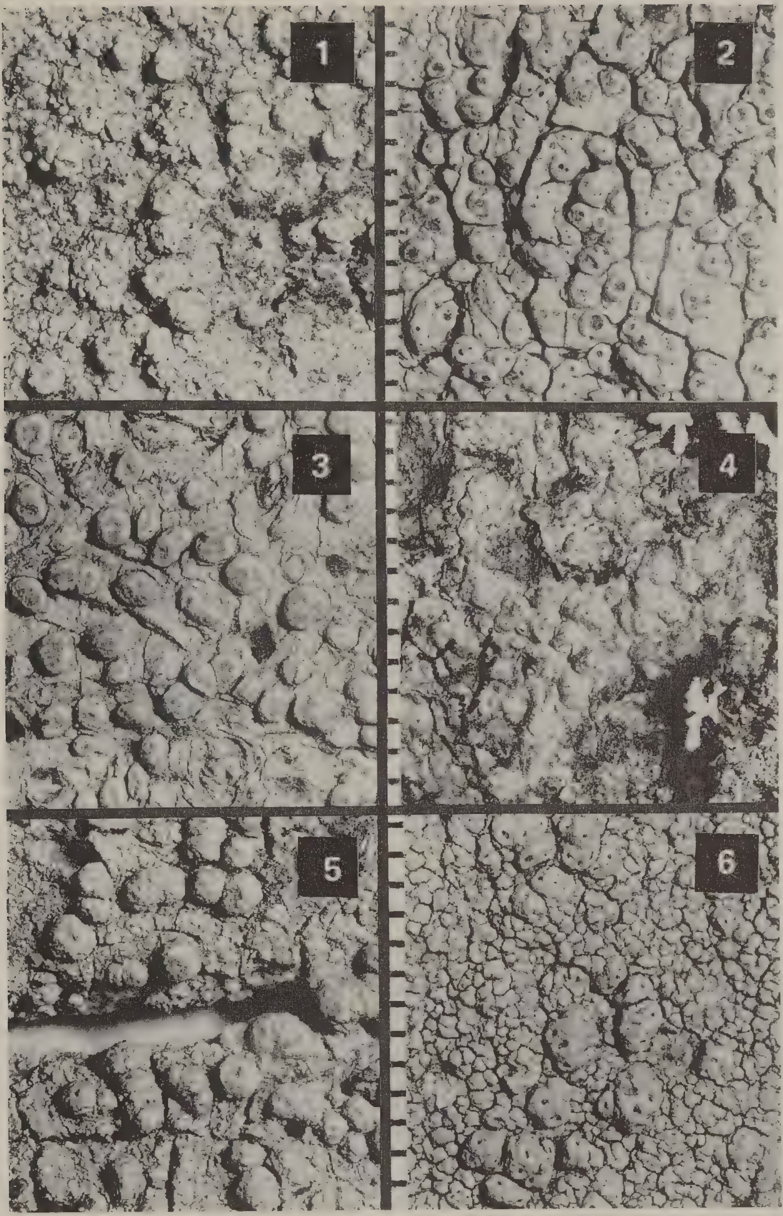
Pertusaria atromaculata Archer & Elix sp. nov. Fig. 2

Thallus albidus vel griseo-albus, grosse areolatus et rimosus, superficies laevis et hebetata, isidiis et sorediis destitutus; corticola; apothecia verruciformia, conspicua, numerosa, thallo concoloria, saepe confluentia, subhemisphaerica vel plano-hemisphaerica, saepe bsaibus constrictis, 0.7-1.0 mm diam.; ostiola conspicua, nigra, punctiformia, 0.05-0.1 mm diam., in zona hyalina 0.3-0.5 mm diam., saepe depressa; sporae 4nae, uniseriatae, ellipsoideae, laeves, 85-120 μm longae, 35-47 μm latae. Thallus acidum sticticum, lichexanthone et 2-chlorolichexanthone continens.

Type: Australia, Queensland, Noosa River, ca. 60 km SE of Gympie, 26°23´S, 153°02´E, on *Excoecaria*, sea-level, *J. Hafellner 19664*, 27.vii.1986; GZU-holotype.

Thallus off-white to pale greyish white, coarsely areolate and cracked, surface smooth and dull, lacking isidia and soredia, corticolous; *apothecia* verruciform, conspicuous, numerous, concolorous with the thallus, sometimes confluent, subhemispherical becoming flattened hemispherical, often constricted at the base, 0.7-1.0 mm diam.; ostioles conspicuous, black, punctiform, 0.05-0.01 mm diam., 1-3 per verruca, set in a translucent zone 0.3-0.5 mm diam., the zone sometimes sunken; *spores* 4 per ascus, uniseriate, ellipsoid, smooth, 85-120 μm long, 35-47 μm wide.
Chemistry: K-, KC-, C-, Pd-; lichexanthone, 2-chlorolichexanthone and stictic acid as major compounds.

P. atromaculata resembles *P. dehiscens* Müll.Arg. in possessing verrucae with sunken ostioles but the new species is differentiated from *P. dehiscens* by the number of spores (8 per ascus in *P. dehiscens*) and the presence of 2-chlorolichexanthone as a major component (absent from *P. dehiscens*). The new species somewhat resembles the four-spored Peruvian species *Pertusaria cryptocarpa* Nyl. (Nylander 1859) but the spores in that taxon are smaller, 62-85 x 25-35 μm; the holotype [Peru, Carabaya; H-NYL 23639] was too small for chemical examination. *P. atromaculata* is distinguished from the four-spored *P. aberrans* Müll.Arg. [described from Victoria (Müller 1893)] by the smaller verrucae and the presence of 2-chlorolichexanthone (absent from *P. aberrans*).



Figs. 1-6. New *Pertusaria* species. 1. *P. asperata*; 2. *P. atromaculata.*; 3. *P. paradoxica*; 4. *P. saltuensis*; 5. *P. subplanaica*; 6. *P. whinrayii*. Scale in mm.

P. atromaculata is characterised by the four-spored asci, the conspicuous black ostioles and the presence of 2-chlorolichexanthone. The new species is known only from the type specimen.

Pertusaria globospora Archer sp. nov.

Thallus olivaceus, tenuis, rimosus,superficies laevis et nitida, isidiis et sorediis destitutus; corticola; apothecia veruciformia, numerosa, conspicua, thallo concoloria, raro confluentia, initio subconica demum valde plano-hemisphaerica, 0.5-1 mm diam.; ostiola conspicua, initio projecta e verrucis, nigra, 0.1-0.15 mm diam. in zona hyalina ca. 0.3 mm diam, demum complanata, disciformis, 0.3-0.5 mm diam. in zona hyalina 0.45-0.6(-0.8) mm diam.; sporae 8nae, uniseriatae, globosa, laeves, 17-20 μm diam., parietibus 3-5 μm crassis.
Thallus acidum norstictium continens.

Type. Australia, Norfolk Island, Duncombe Bay Road, near entrance to Mt. Pitt Reserve, 29°00´30"S, 167°56´E, alt. 50 m, on felled *Araucaria heterophylla*, *J. A. Elix 18719*, 7.xii.1984; ANUC-holotype.

Thallus olive green, thin, cracked, surface smooth and shiny, lacking isidia and soredia; corticolous; *apothecia* verruciform, numerous, conspicuous, concolorous with the thallus, rarely confluent, initially sub-conical, becoming very flattened hemispherical, 0.5-1 mm diam.; ostioles conspicuous, initially protruding, black, 0.1-0.15 mm diam. in a hyaline zone 0.45-0.6(0.8) mm diam; *spores* 8 per ascus, uniseriate, circular, smooth, 17-20 μm diam., spore wall 4-5 μm thick.
Chemistry: K+ yellow becoming red, KC +red, C-, Pd+ yellow; norstictic acid.

Specimen examined.
NORFOLK ISLAND, track at end of Selwyn Pine Road, 29°01´S, 167°56´30"E, alt. 200 m, on *Araucaria heterophylla*, *H. Streimann* 34603, 8.xii.1984 (CBG 9003886).

Spores in the genus *Pertusaria* are usually ellipsoid or fusiform but *P. globospora* has eight globose spores per ascus. A specimen of an un-named corticolous *Pertusaria* from New Zealand [*J. A. Elix 8086*, 12.v.1980 (ANUC)] also has eight round spores per ascus,12-15 μm diam., but these spores have a thin wall, ca. 1 μm thick; in addition, this specimen has disciform apothecia with white pruinose discs and contains a triterpene and is thus distinct from *P. globospora.*
The new species is characterised by the globose spores, the conspicuous ostioles and the presence of norstictic acid; at present it is known only from Norfolk Island.

Pertusaria paradoxica Archer & Elix sp. nov. Fig.3

Thallus flavovirescens vel cinero-virescens, rugosus et rimosus, superficies laevis et hebetata, isidiis et sorediis destitutis; corticola; apothecia verruciformia, conspicua, saepe confluentia, thallo concoloria, plano-hemisphaerica, basibus constrictis, 0.8-1.4 mm diam.; ostiola inconspicua, albo-hinnulea vel fusca, in verucas 1-4 na, in zona subhyalina; sporae 8 nae, irregulariter uniseriatae, ellipsoideae vel subfusiformes, laeves, (75-)80-100 μm longae, (25-)30-40 μm latae.
Thallus acida thiophaninicum, sticticum et 4-*O*-methylisocryptochlorophaeicum continens.

Type: Australia, Queensland, slopes of Black Mountain, 25 km NW of Kuranda, 16°40´S, 145°29´E, 500 m, on *Acacia* in stunted rainforest, *J. A. Elix 17541*, 7.vii.1984; ANUC-holotype.

Thallus pale yellowish-grey to pale greenish-grey, wrinkled and cracked, surface smooth and dull, lacking isidia and soredia, corticolous; *apothecia* verruciform, sparse or

numerous, sometimes confluent, concolorous with the thallus, flattened hemispherical, becoming constricted at the base, 0.8-1.4 mm diam.; ostioles inconspicuous, pale, translucent to black, 1-4 per verruca; *spores* 8 per ascus, irregularly uniseriate, ellipsoid to subfusiform, smooth, (70-)80-105 μm long, (25-)30-40(-45) μm wide.
Chemistry: K+ weak yellow, KC+ violet, C+ violet, Pd -; 4-*O*-methylisocryptochlorophaeic acid (major), thiophaninic (minor), stictic (major) and constictic (minor) acids.

Specimens examined:
QUEENSLAND, Conway State Forest, 18 km E of Proserpine, 20°21´S, 148°45´E, 180 m, on *Albizzia* in lowland rain forest, *J. A. Elix 20223*, 28.vi.1986 (ANUC); Noosa River NE of Tewantin, ca. 70 km SE of Gympie, 26°23´S, 153°02´E, sea-level, on *Excoecaria, J. Hafellner 19630*, 27.vii.1986 (GZU).
NEW SOUTH WALES, Barrington Tops National Park, NE of Scone, in subtropical rain-forest, 32°05´S, 151°30´E, 500 m, *K.Kalb 18018*, 9.viii.1988 (herb. KALB); Blue Mountains, track by side of Sassafras Creek, ca. 1 km S of Springwood, 65 km W of Sydney, *K.Kalb 18870*, 29.vii.1988 (herb. KALB); ibid., *A.W.Archer P 221, P223*, 23.xi.1991 (NSW).

P. paradoxica has verruciform apothecia with double walled spores, features which place the taxon in *Pertusaria* subgenus *Pertusaria* (Dibben 1980). Chemically, this subgenus is characterised by the presence of orcinol *para*-depsides, such as derivatives of perlatolic acid, in contrast to subgenus *Pionospora* (Fries) Dibben (Dibben, loc. cit.) which is characterised by the presence of depsones, orcinol *para*-depsides, such as lecanoric acid, and β-orcinol *meta*-depsides such as thamnolic acid. *P. paradoxica* is differentiated from other taxa in subgenus *Pertusaria* by the presence of the novel *meta*-depside, 4-*O*-methylisocryptochlorophaeic acid [2,4-dimethyoxy-5-*n*-pentylbenzoyloxy-2,4-dihydroxy-5-*n*-pentylbenzoic acid]. This compound represents a new class of orcinol *meta*-depsides, linked at the 5' position, in contrast to the normal 3' position, cf. 4-*O*-methylcryptochlorophaeic acid.

The new compound gives a pale brownish grey colour with sulphuric acid and has the following Rf values in solvents A, B and C (Culberson 1972): A 0.43; B 0.48; C 0.45.

A detailed account of the isolation, identification and synthesis of 4-*O*-methylisochlorophaeic acid will be given elsewhere.

The epithet "paradoxica" refers to the unusual and unexpected presence of an orcinol *meta*-depside in the genus *Pertusaria.*

P. paradoxica is characterised by the eight-spored asci and the presence of 4-*O*-methylisochlorophaeic acid; it occurs in rain forest in Queensland and New South Wales.

Pertusaria planaica Archer & Elix sp. nov.

Thallus albido-olivaceus, surrimosus et subtuberculatus, superficies laevis et nitida, isidiis et sorediis destitutus; corticola; apothecia verruciformia, inconspicua, dispersa, saepe confluentia, thallo concoloria, plano-hemisphaerica, basibus non constrictis, 0.5-0.8 mm diam.; ostiola inconspicua, punctiformia, nigra, in verrucas singulas; sporae 8nae, irregulariter uniseriatae, laevis, ellipsoideae, fusiformescentes, 80-100 μm longae, 25-35 μm latae.
Thallus acidum planaicum et 4,5-dichlorolichexanthone continens.

Type: Australia, Queensland, W of road from Goondiwindi to Miles, 63.5 km N of Goondiwindi, 28°00´S, 150°20´E, alt. 400 m, *J. Hafellner 18715*, 2.ix.1986; GZU-holotype.

Thallus pale greenish-grey, slightly cracked and subtuberculate, surface smooth and shiny, lacking isidia and soredia; corticolous; *apothecia* verruciform, inconspicuous,

dispersed, sometimes confluent, concolorous with the thallus, flattened hemispherical, not constricted at the base, 0.5-0.8 mm diam.; ostioles inconspicuous, black, one per verruca; *spores* 8 per ascus, irregularly uniseriate, smooth, ellipsoid, becoming fusiform, 80-100 μm long, 25-35 μm wide.
Chemistry; K-, KC-, C-, Pd-; 4,5-dichlorolichexanthone and planaic acid as major compounds.

Specimen examined.
NEW SOUTH WALES, Barrington Tops National Park, N of Scone, in subtropical rain forest, 32°05´S, 151°30´E, alt. 500 m, *K. Kalb 21803*, 9.viii.1988 (herb. KALB).

Planaic acid is an uncommon depside in the genus *Pertusaria* and was reported as only a trace compound present in the North American *Pertusaria* species, *P. arizonica* Dibben, *P. neoscotia* Hale and *P. paratuberculifera* Dibben (Dibben 1980, p. 84, 97, 101) and was not present in any of the European specimens examined by Hanko (Hanko 1983). However in *P. planaica* this compound is present as a major component together with 4,5-dichlorolichexanthone. An un-named *Pertusaria* species from Armidale, New South Wales [W.A.Weber, 24.x.1968 (CBG 9201743, COLO L49884)] also contains 4,5-dichlorolichexanthone and planaic acid but this specimen has four rough spores per ascus. *P planaica* resembles *P. subplanaica* (infra) somewhat, but is distinguished from that species by the presence of planaic acid. *P. planaica* occurs in subtropical rainforest in Queensland and New South Wales.

Pertusaria saltuensis Archer & Elix sp. nov. Fig.4

Thallus flavo-albus vel flavovirescens, tenuis, discontinuus, rimosus, superficies laevis et nitida, isidiis et sorediis destituta; corticoloa; apothecia verruciformia, inconspicua,confluentia vel raro solitaria, thallo concoloria, perplano-hemisphaerica, basibus non constrictis, 0.5-0.8 mm diam.; ostiola inconspicua, nigra, 0.05 mm diam., in verrucas singulas; sporae 2nae, ellipsoideae, laeves, 105-117 μm longae, 35-40 μm latae.
Thallus acidum thiophanicum, 4,5,7-trichloronorlichexanthone et arthothelin continens.

Type: Australia, Queensland, Lannercost State Forest, Old Mill Rd., 40 km WSW of Ingham, 18°46´S, 145°48´E, 640 m, on base of eucalypt, *J.A. Elix 15471*, 19.vi.1984; ANUC-holotype.

Thallus pale yellowish-white to pale yellowish-green, thin, discontinuous, cracked, surface smooth and shiny, lacking isidia and soredia, corticolous; *apothecia* verruciform, inconspicuous, confluent or rarely solitary, concolorous with the thallus, very flattened hemispherical, not constricted at the base, 0.5-0.8 mm diam.; ostioles inconspicuous, black, 0.05 mm diam., 1 per verruca; *spores* 2 per ascus, ellipsoid, smooth, 105-117 μm long, 35-40 μm wide.
Chemistry: K-, KC+ orange, C+ weak orange, Pd-; thiophanic acid (major), 4,5,7-trichloronorlichexanthone (minor) and arthothelin (minor), with traces of 4,5,7-trichloro-6-*O*-methylnorlichexanthone and 4,5-dichloronorlichexanthone.

P. saltuensis resembles *P. pycnothelia* Nyl. (Nylander 1867) with regard to the number, shape and size of spores, the often confluent, small flattened verrucae and the inconspicuous ostioles, but differs chemically; the isolectotype of *P.pycnothelia* [H-NYL 22960, New Caledonia, Loyalty Islands, Lifu, *Thiébaut s.n.*, 1864 here selected as lectotype; H-NYL 22961, isolectotype] contains 4,5-dichlorolichexanthone and 2'-*O*-methylperlatolic acid with traces of stictic acid.
The epithet "saltuensisis" is derived from the Latin "saltus", glade, cf. Lannercost, from the Welsh root, "llanerch", glade.
The new species is known only from the type specimen from Queensland.

Pertusaria subplanaica Archer & Elix sp. nov. Fig.5

Thallus albido-olivaceus, surrimosus, superficies laevis et hebetata, isidiis et sorediis destituta; corticola; apothecia verruciformia, conspicua, dispersa, saepe confluentia, thallo concoloria, plano-hemisphaerica, basibus constrictis, 0.8-1.5 mm diam.; ostiola inconspicua, fusca, in verrucas singulas; sporae 8nae, irregulariter uniseriatae, laeves, ellipsoideae, fusiformescentes, (60-)80-100(-120) μm longae, 30-40 μm latae. Thallus acidum 2,2'-di-*O*-methylstenosporicum et 4,5-dichlorolichexanthone continens.

Type: Australia, New South Wales, Patterson River [near junction with Hunter River, *ca.* 10 km E of Maitland, 32°44'S, 151°33'E], *J. L. Boorman s.n.*, -.viii.1906; NSW-holotype.

Thallus pale olive green somewhat cracked, surface smooth and dull, lacking isidia and soredia, corticolous; *apothecia* verruciform, conspicuous, dispersed, sometimes confluent, concolorous with the thallus, flattened hemispherical, constricted at the base, 0.8-1.5 mm diam.; ostioles inconspicuous, brown, 1 per verruca; *spores* 8/ascus, irregularly uniseriate, smooth, ellipsoid becoming fusiform, (60-)80-100(-120) μm long, 30-40 μm wide.
Chemistry: K-, KC-, C-, Pd-; 4,5-dichlorolichexanthone and 2,2'-di-*O*-methylstenosporic acid with traces of planaic and 2,2'-di-*O*-methyldivaricatic acids.

Specimens examined.
QUEENSLAND. Mt. Mee State Forest, ca. 1 km NW of Forest Station, 27°04'S, 152°45'E, alt. ca. 500 m, in rain forest, *J. Hafellner 16887*, 13.viii.1986 (GZU); Gambubal State Forest, Cons Plain, E of Emu Mtn, 28°14'S, 152°25'E, alt. 1100-1200 m, in rain forest, *J. Hafellner 16339*, 7.ix.1986 (GZU).
NEW SOUTH WALES. Blue Mountains N.P., Mt. Wilson, Chimney Cottage, in temperate rain forest, 33°30'S, 150°23'E, alt. 1000 m, *K. Kalb 20468*, 31.vii.1988 (herb. KALB); Royal N.P., Bola Creek, E of Waterfall, 34°08'S, 151°02'E, alt. 250 m, in temperate rain forest, *K. Kalb 21690, 21700*, 2.viii.1988 (herb. KALB).

P. subplanaica resembles three other eight-spored corticolous *Pertusaria* species recently described from Australia: *P. paragibberosa* Archer (Archer 1991a, Fig. 6), *P. novaehollandiae* Archer (Archer 1992, Fig.2) and *P. planaica* (*vide supra*). All four species have well-defined verrucae and contain 4,5-dichlorolichexanthone but are distinguished by the presence of different orcinol depsides; *P. paragibberosa* contains 2'-*O*-methylperlatolic acid, first reported from *Pertusaria* by Culberson & Dibben (Culberson & Dibben 1972); *P. novaehollandiae* contains miriquidic acid, the first report of this depside in *Pertusaria* (Archer 1992) and *P. planaica* contains planaic acid. The new species described here contains two new depsides, 2,2'-di-*O*-methylstenosporic acid and 2-2'-di-*O*-methyldivaricatic acid, lower homologues of planaic acid. The new compounds resemble planaic acid in Rf values and like planaic acid give no colour with MBTH (Archer 1978) and a yellow colour with sulphuric acid (Culberson & Kristinsson 1970). The isolation, identification and synthesis of 2,2'-di-*O*-methylstensporic acid and 2-2'-di-*O*-methyldivaricatic acid will be reported elswhere. *P. subplanaica* is characterised by the eight spored asci and the presence of 4,5-dichlorolichexanthone and 2,2'-di-*O*-methylstenosporic acid; it occurs in temperate rain forest in eastern Queensland and New South Wales.

Pertusaria whinrayii Archer sp. nov Fig.6

Thallus hinnuleus, crassus, areolatus et rimosus, superficies laevis et hebetata, isidiis et sorediis desitutus; saxicola; apothecia verruciformia, sparsa, vulgo confluentia, sub-hemisphaerica vel plano-hemisphaerica, thallo concoloria, basibus constrictis, 0.8-2 mm

diam.; ostiola conspicua, nigra, depressa, 0.1-0.15 mm diam., in verrucas 1-2nas; sporae 2nae, ellipsoideae, parietibus interioribus undulatis ("asper" sensu Dibben 1980), (136-)150-200 μm longae, 40-50 μm latae.
Thallus 4,5-dichlorolichexanthone et acidum norsticticum continens.

Type: Australia, Tasmania, Bass Strait, Badger Island, Furneaux Group, ca. 1.7 km ENE of the tip of Unicorn Point, alt. ca. 5.4 m, on low quartzite outcrop,ca. 22 m in from high water level, *J. S. Whinray, 10.x.1975*; MEL 1019470-holotype.

Thallus fawn, thick, areolate and cracked, surface smooth and dull, lacking isidia and soredia, saxicolous; *apothecia* verruciform, sparse, usually confluent, subhemispherical to flattened hemispherical, concolorous with the thallus, constricted at the base, 0.8-2 mm diam.; ostioles black, conspicuous, sunken, 0.1-0.15 mm diam., 1 or 2 per verruca; *spores* 2 per ascus, ellipsoid, rough, (136-)150-200 μm long, 40-50 μm wide.
Chemistry: K+ yellow becoming red, KC-, C-, Pd+ yellow; 4,5-dichlorolichexanthone and norstictic acid with an unidentified compound.

P. whinrayii externally resembles the New Zealand saxicole *P. lavata* Müll.Arg. but differs from that species chemically and in the number of spores per ascus. This new species is distinguished from the two-spored New Zealand *P. subverrucosa* Nyl. by the rough spores (smooth in *P. subverrucosa*) and the presence of 4,5-dichlorolichexanthone. *P. whinrayii* also resembles the two-spored saxicole *P.tjibodana* Zahlbr. [described from Indonesia (Zahlbruckner 1928)] but the latter species contains 4,5-dichlorolichexanthone and stictic acid.
P. whinrayii is characterised by the asci with two rough spores and the presence of 4,5-dichlorolichexanthone and norstictic acid; it is known only from the type specimen from Tasmania.

Pertusaria xylophyes Archer sp. nov.

Thallus subflavidus, tenuis, saepe discontinuus, superficies subtuberculata et hebetata, isidiis et sorediis destitutus; corticola; apothecia verruciformia, numerosa, dispersa, raro confluentia, plano-hemisphaerica, thallo concoloria, basibus non constrictis, 0.75-1.5 mm diam.; ostiola conspicua, hinnulea vel fusca, 0.05-0.2 mm diam., in verrucas singulas; sporae 8nae, uniseriatae, ellipsoideae vel subfusiformes, laeves, 60-82 μm longae, 30-42 μm latae.
Thallus acida thiophanicum et 2-*O*-methylperlatolicum continens.

Type: Australia, Queensland, Mt. Fox, 43 km SW of Ingham, 18°50´S, 145°42´E, alt. 740 m, on fallen eucalypt, *J. A. Elix 20366*, 19.vi.1986; ANUC-holotype.

Thallus dull yellow, thin sometimes discontinuous, areolate and cracked, surface subtuberculate and dull, lacking isidia and soredia; corticolous; *apothecia* verruciform, numerous, scattered, rarely confluent, flattened hemispherical, concolorous with the thallus, not constricted at the base, 0.75-1.5 mm diam.; ostioles conspicuous, pale to dark brown, 0.05-0.2 mm diam., 1 per verruca; *spores* 8 per ascus, uniseriate, ellipsoid to subfusiform, smooth, 60-82 μm long, 30-42 μm wide.
Chemistry: K-, KC+ weak yellow, C-, Pd-; thiophaninic acid and 2-*O*-methylperlatolic acid with traces of lichexanthone and 2-chloro-6-*O*-methylnorlichexanthone.

Specimens examined.
QUEENSLAND, Mt. Fox, 43 km SW of Ingham, alt. 700m, H. Streimann 37119, 19.vi.1986 (CBG 9003894; B, NY).
NEW SOUTH WALES, Telegherry Forest Park, Chichester State Forest, 20 km N of Dungog, 32°15´S, 151°43´E, alt. 350 m, *H. Streimann 38383*, 24.viii. 1987 (CBG 9201738)

Pertusaria xylophyes is the corticolous analogue of the Australian saxicolous *Pertusaria petrophyes* Knight (Knight 1882, Archer 1991) which it resembles both morphologically and chemically; the epithet "xylophyes" is formed by analogy with "petrophyes". The new species somewhat resembles the eight-spored Brazilian species *Pertusaria araucariae* Müll.Arg. (Müller 1884) but the spores in the holotype [Brazil, Apiahy, Puiggari s.n., 1881 (G)] are biseriate in contrast to the uniseriate spores in *Pertusaria xylophyes.* The new species is characterised by the eight spored asci and the presence of thiophaninic and 2-*O*-methylperlatolic acids; it occurs in Queensland and New South Wales.

NEW REPORTS

Pertusaria ceylonica Müll.Arg., *Flora* 67: 351 (1884).

Type: Ceylon [Sri Lanka], s. loc., *G. Thwaites s.n.*, 1876 (sic); holo: G; iso: H-NYL pm 3700.

Pertusaria trisperma Müll.Arg., *Flora* 67: 398 (1884).
Type: Ceylon [Sri Lanka], s. loc., *G. Thwaites s.n.*, 1876 (sic); holo: G.

Pertusaria impressula Müll.Arg., *Flora* 67: 460 (1884).
Type: Ceylon [Sri Lanka], s. loc., *G. Thwaites s.n.*, 1876 (sic); holo: G.

Pertusaria blumeana Müll.Arg., *Hedwigia* 31: 281 (1892).
Type: Java [Indonesia] s. loc., *Blume s. n.*, 1891; holo: G.

Thallus pale greenish grey, slightly areolate and cracked, surface smooth and shiny, lacking isidia and soredia, corticolous; *apothecia* verruciform, numerous, scattered or sometimes confluent, concolorous with the thallus, flattened hemispherical, 0.4-0.6 mm diam.; ostioles black, punctiform, 1, or rarely 2, per verruca; *spores* 3, rarely 4, per ascus, ellipsoid, smooth, uniseriate, (75-)80-100(-112) μm long, 30-45(-50) μm wide. *Chemistry*: K+ weak yellow, KC-, C -, Pd+ weak yellow; 2,5-dichlorolichexanthone and stictic acid, with constictic acid, 2,4-dichlorolichexanthone and 2,4,5-trichlorolichexanthone as minor compounds.

Specimens examined.
AUSTRALIA, Northern Territory, Kakadu National Park, Kapalga, in monsoon forest, *M. Day s.n.*, 24.vii.1981 (ANUC); ibid., Baroalba Creek, 19 km S of Jabiru, 12°50´S, 132°53´E, alt. 70 m, on rain forest tree, *J.A.Elix 22574*, 25.v.1988 (ANUC).

P. ceylonica is chemically similar to *P. cicatricosa* Müll.Arg. (Archer 1992) but is distinguished from that species by the four-spored asci. *P. ceylonica* is a tropical to subtropical species which occurs in Sri Lanka, Indonesia and northern Australia. The dating of the type specimens is discussed under *P. thwaitesii* (infra).

Pertusaria lavata Müll.Arg., *Flora* 67: 462 (1884).

Type: New Zealand, s. loc., Knight 1883; holo: G 638/3, fide D.J. Galloway: 375 (1985) (n.v.).

Thallus pale greyish-white to pale fawn, thick, coarsely areolate and cracked, lacking isidia and soredia, surface smooth and dull, saxicolous; apothecia verruciform, numerous, crowded, often confluent, concolorous with the thallus, flattened hemispherical, 0.7-1.0 mm diam.; ostioles conspicuous, black, punctiform, surrounded

by a pale translucent zone, 1 per verruca; spores 8 per ascus, usually 6-8, ellipsoid to subfusiform, smooth, predominantly biseriate, 85-105 μm long, 30-40 μm wide.
Chemistry: K-, KC-, C-, Pd-; 4,5-dichlorolichexanthone and 2'-*O*-methylperlatolic acid.

Specimens examined.
AUSTRALIA, Queensland, Castle Crag, Lamington National Park, *S. Brownlie A90a* , 28.v.1969 (MEL 1023514);
New South Wales, Woolonebi (sic) Falls, under rock overhang, [?near Wollonbi] *S. Brownlie s.n.* (MEL 1023427).

NEW ZEALAND, Broken Islands, off Great Barrier Island, 36°13´S, 175°17´E, *B. Hayward s.n.*, Jan. 1985 (AK 172636); Auckland, Kawakauia Bay, Papanni Point, 36°56´S, 175°13´E, *H. Mayrhofer 5896*, 8.i.1985 (GZU); Bay of Islands, Tapeka Point, 35°15´S, 174°07´E, *W. Nelson, s.n.*, 27.iv.1990 (WELT L3219).

P. lavata is distinguished from the chemically similar, eight-spored saxicolous *P. lophocarpa* Körber (which also occurs in eastern Australia and New Zealand) by the confluent verrucae and the ostioles, which are conspicuously sunken in *P. lophocarpa*. *P. lavata* occurs in Qld and N.S.W, and also in New Zealand, often on coastal rocks.

Pertusaria leioplacella Nyl., *Bull. Soc. Linn. Normandie* sér.2, 2:71 (1867).

Type: New Caledonia, Lifu, *E. Marie s.n.*, 1863; lecto: H-NYL 23640 (fide Awasthi & Srivastava); isolecto: H-NYL 23643.

Pertusaria amblyogona Müll.Arg., *Bull. Herb. Boissier* 3: 638 (1895).
Type: Australia, Queensland, Toowoomba, *Hartmann s.n.*, 1894; holo: G.

Pertusaria confluens Müll.Arg., *Bull. Herb. Boissier* 3: 638 (1895).
Type: Australia, Queensland, Toowoomba, *Hartmann s.n.*, 1894; holo: G.

Thallus off-white to pale yellowish-white, areolate and cracked, surface smooth and dull, lacking isidia and soredia, corticolous; *apothecia* verruciform, numerous, scattered, sometimes confluent, flattened hemispherical, concolorous with the thallus, 0.5-1(-1.5) mm diam.; ostioles inconspicuous, translucent, pale yellow, 1 per verruca; *spores* 8 per ascus, usually 6-8, irregularly uni- or biseriate, ellipsoid, smooth, 52-72 μm long, 28-32 μm wide.
Chemistry: K-, KC+ orange, C+ orange, Pd-; thiophaninic and stictic acids with traces of hypostictic and constictic acids.

Pertusaria leioplacella was first reported to occur in Australia in the 19th. century (Bailey 1883, Shirley 1889, Wilson 1890) and the chemistry of this species has been reported more recently (Archer 1991a). The revised chemistry of this species is shown in Table 1. Müller described *P. meridionalis* var. *xanthostoma* based on material collected in South America (Müller 1881) and the variety was later reported to occur in Australia (Müller 1891). The chemistry of the Australian specimen on which this report was based differs from that of the lectotype of var. *xanthostoma* from South America [Table 1]. Müller later described *P. amblyogona* based on an Australian specimen and the chemistry of that holotype is also shown in Table 1. *P. amblyogona* was originally reported as a synonym of var. *meridionalis* on the basis of the chemical similarity between the holotype of *P. amblyogona* and the 1889 Australian specimen of "var. *xanthostoma* " (Archer 1991). *P. confluens* was based on a specimen from the same collector and locality as *P. amblyogona* and the revised chemistry of this taxon is shown in Table 1. A comparison of the chemistry and morphology of *P. leioplacella, P. amblyogona* , *P. confluens* and the Australian specimen of "var. *xanthostoma*" has shown them to be identical and they are united under the earliest epithet, *P. leioplacella.*

The distribution of *P. leioplacella* in Australia and elsewhere has been reported previously (Archer 1991a) and now includes those specimens previously recorded as *P. meridionalis* var. *xanthostoma* (Archer 1991). *P. leioplacella* was also reported from Ceylon (Leighton 1869) but the specimen on which this report was based later became the holotype of *P. subdepressa* Müll.Arg. (Müller 1884); it contains 4-chloro-6-*O*-methylnorlichexanthone as a major compound together with minor amounts of other chlorinated xanthones and differs from *P. leioplacella.*

The South American lectotype of *Pertusaria meridionalis* var. *xanthostoma* is chemically and morphologically identical with the holotype of *P. flavens* Nyl. described from Martinique (Nylander 1869), the chemistry of which is shown in Table 1. The two specimens differ only in colour; *P. flavens* being somewhat more yellow than var. *xanthostoma.* Müller noted the similarity of his new variety with *P. flavens* but differentiated them on the basis of colour and the appearance of the ostioles (Müller 1881). Müller reported *P. flavens* from the Carribean and Socotra (Müller 1884) but made no further comparison with his previously described variety. *P. meridionalis* var. *xanthostoma* is considered to be a later name for *P. flavens* as was implied by Malme who could find no difference between the two taxa (Malme 1936: 25). No Australian specimens corresponding to *P. flavens* have been seen. The recently described *P. thiophaninica* Archer (Archer 1991a), although chemically similar to *P. flavens,* has larger spores (Table 1) and lacks the yellow ostioles present in the latter species.

TABLE 1

AUSTRALIAN CORTICOLOUS *PERTUSARIA* TAXA WITH 8 SPORES PER ASCUS CONTAINING THIOPHANINIC ACID

Taxon	**Chemistry ***	**Spores**
Pertusaria flavens Nyl. Holotype: H-NYL 23632	thiophaninic acid	52-65 x 27-32 μm
Pertusaria meridionalis var. *xanthostoma* Müll.Arg. Lectotype: Puiggari 1221; G	thiophaninic acid	48-70 x 22-37 μm
Australia, Bailey s.n., 1889; G	thiophaninic, stictic and hypostictic acids	60-75 x 30-39 μm
Pertusaria amblyogona Müll.Arg. Holotype: Hartmann s.n., 1894; G	thiophaninic, stictic and hypostictic acids	62-70 x 25-32 μm Müller: 70 x 32 μm
Pertusaria confluens Müll.Arg. Holotype: Hartmann s.n.,1894; G	thiophaninic, stictic and hypostictic acids	48-60 x 23-30 μm Müller: 45-65 x 20-26 μm
Pertusaria leioplacella Nyl. Lectotype: H-NYL 23640	thiophaninic, stictic and hypostictic acids	52-72 x 28-32 μm Malme: 45-65 x 20-26 μm
Pertusaria thiophaninica Archer Holotype: MEL 1020691	thiophaninic acid	75-95 x 30-40 μm

* The chemistry was determined by thin layer and liqiud chromatography of extracts from holotypes or lectotypes.

Pertusaria leucoplaca Müll.Arg., *Flora* 67: 304 (1884).

Type: Brazil, Apiahy, sur *Araucaria*, *Puiggari 2128*, Oct. 1882; holo: G.

Pertusaria acuta Müll.Arg., *Flora* 67: 353 (1884).
Type: India, in montibus Neilgherries [Nilgiri Hills, ca. 120 km SSW of Bangalore], on *Cinchona succirubris*, *Bader s.n.*; holo: G.

Thallus greyish-white, areolate and cracked, surface smooth and dull, lacking isidia and soredia, corticolous; *apothecia* verruciform, conspicuous, scattered, flattened hemispherical, sometimes constricted at the base, concolorous with the thallus, sometimes slightly concave above, 0.8-1.5 mm diam.; ostioles conspicuous, pale brown to dark brown to black, 1, rarely 2, per verruca; *spores* 8 per ascus, biseriate or irregularly biseriate, subfusiform to fusiform, smooth, (65-)70-90(-100) μm long, 25-35 μm wide.
Chemistry: K-, KC-, C-, Pd-; 2-*O*-methylstenosporic acid with traces of 2-*O*-methylperlatolic and 2-*O*-methyldivaricatic acids.

Specimens examined.
NEW SOUTH WALES, Royal National Park, Bola Creek, E of Waterfall, in temperate rain forest, 34°08´S, 151°02´E, 250 m, *K. Kalb 18894, 21717*, 2.viii.1988 (Herb. KALB); Olney State Forest, ca. 25 km W of Morisset, 33°07´S, 151°12´E, alt. 200 m, *A. Archer P 166*, 17.v.1991 (NSW); Mt. Ebsworth Rd., near Sawpit Creek, 4 km SW of Stroud, 32°33´S, 151°55´E, alt. ca. 70 m, *A. Archer P194*, 21.vi.1991 (NSW); Murramarang National Park, behind Oakey Beach, ca. 10 km N of Batemans Bay, on dead branch, 35°42´S, 150°16´E,alt. 10 m, *A. Archer P301*, 31.iii.1992 (NSW).

P. leucoplaca resembles the Australian species *P. leucostigma* Müll.Arg. (with which it is often found) but is distinguished from that species by the absence of lichexanthone, the darker ostioles and the slightly smaller biseriate spores. In addition, *P. leucoplaca* contains 2-*O*-methylstenosporic acid as the major lichen compound in contrast to *P. leucostigma* which contains 2'-*O*-methylperlatolic acid together with lichexanthone as major compounds. Müller (loc.cit.) described the ostioles in *P.leucoplaca* as pale becoming black, and those in *P. acuta* as brown becoming black; the ostioles in the specimens reported above range from pale brown to black. The spores in both holotypes (vide supra) are similar in size, shape and arrangement and both holotypes have the same chemistry - hence the two taxa are considered to be synonymous. *P. leucoplaca* is characterised by the eight biseriate spores and the presence of 2-*O*-methylstenosporic acid; it occurs in Brazil, Sri Lanka and in Australia where it is found in temperate rain forest in New South Wales.

Pertusaria microstoma Müll.Arg., *Flora* 65: 328 (1884).

Type: Java [Indonesia] s. loc., hb. Lugd. Bat., 1882; holo: G.

Thallus olive green, areolate and cracked, surface dull and tuberculate due to numerous confluent verrucae; *apothecia* verruciform, conspicuous, numerous, crowded, often confluent, single verrucae 0.4-0.7 mm diam., flattened hemispherical, sometimes constricted at the base; confluent verrucae 1-1.5 mm diam.; ostioles conspicuous, black, 0.05-0.1 mm diam., sometimes in a hyaline zone; *spores* 4 per ascus, ellipsoid, rough, 82-105(-135) μm long, 35-45 μm wide.
Chemistry: K-, KC-, C-, Pd-; stictic acid, 2'-O-methyperlatolic acid and 4,5-dichlorolichexanthone with traces of constictic and planaic acids.

Specimens examined.

PAPUA NEW GUINEA, Morobe Province, Upper Watut logging area, 12 km SE of Bulolo, 7°19´S, 143°37´E, alt. 1720 m, *H. Streimann 33077*, 2.i.1983, (B, CBG 9201718).
AUSTRALIA, Queensland, Lake Barrine National Park, [W of Cairns], alt. 735 m, on dead wood in rain forest, *J.A.Elix 2611*, 27.viii.1976 (ANUC); Black Mountain, 25 km NW of Kuranda, 16°40´S, 145°28´E, alt. 500 m, *J.A.Elix 17540*, 7.vii.1984; Mt. Fox, 43 km SW of Ingham, 18°51´S, 145°42´E, alt. 780 m, *H. Streimann 37012*, 19,vi,1986 (CBG 9201745).

P. microstoma is chemically similar to the four-spored *P. hermaka* Archer (Archer 1991) but is distinguished from that species by the rough spores and the more confluent verrucae. Additional specimens were reported from the Buitenzorg Botanical Gardens and Mt.Tjibodas in Indonesia by Zahlbruckner (Zahlbruckner 1928) who noted spore lengths of 96-150 μm. *P. microstoma* is characterised by the asci with four rough spores and the presence of 4,5-dichlorolichexanthone, 2'-*O*-methylperlatolic and stictic acids; it occurs in Indonesia, Papua New Guinea and north-eastern Australia.

Pertusaria rigida Müll.Arg., *J. Linn. Soc. (Bot.)* 29: 221 (1893).

Type: India, Manipoor [Manipur], *G. Watt s.n.*, ex Herb Kew 1891; holo: G.

Thallus pale greyish olive, minutely areolate and cracked, surface smooth and dull, lacking isidia and soredia, corticolous; *apothecia* verruciform, numerous, often confluent, concolorous with the thallus, flattened hemispherical, 0.8-1.5 mm diam.; ostioles conspicuous, black, 1 (rarely 2) per verruca, more in confluent verrucae; *spores* 8 per ascus, sometimes 4-6 per ascus, ellipsoid to subfusiform, irregularly biseriate, smooth, 75-88 μm long, 32-37 μm wide.
Chemistry: K-, KC-, C-, Pd-; 4,5-dichlorolichexanthone only.

Specimens examined.
QUEENSLAND, Hervey Range, 45 km SW of Townsville, 19°26´S, 146°24´E, 350 m, on *Timonius*, *J. A. Elix 20437*, 20.vi.1986 (ANUC).
NEW SOUTH WALES, Mt. Ulandra, 30 km NW of Junee, 34°49´S, 147°55´E, 700 m, on *Acacia* in *Callitris* dominated dry sclerophyll forest, *J.A.Elix 23188*, 16.xi.1989 (ANUC).

P. rigida is characterised by the eight-spored asci and the presence of the dichloroxanthone as the sole lichen compound. This species resembles the Australian taxon *P. irregularis* Müll.Arg (J. Müller 1895) chemically but the latter taxon has 2 spores per ascus. *P. rigida* occurs in India and Australia (Queensland and New South Wales).

Pertusaria thwaitesii Müll.Arg., *Flora* 67: 470 (1884).

Type: Ceylon [Sri Lanka], [Peradeniya, *fide* Leighton 1869], *G. Thwaites s.n.*, 1876 (vide infra); holo: (G).

Pertusaria wilsonii Archer, *Mycotaxon* 41: 250 (1991).
Type: Australia, Queensland, Clarke Range, 46 km S of Proserpine, 20°50'S, 148°32'E, alt. 800 m, on dead log, *J. A. Elix 20943*, 29.vi.1986 (ANUC).

Thallus off-white to pale grey, wrinkled, cracked and areolate, surface dull, lacking isidia and soredia, corticolous; *apothecia* verruciform, conspicuous, concolorous with the thallus, numerous, very flattened hemispherical or irregular in outline, 1-2 mm wide; ostioles numerous, conspicuous, pale becoming black, punctiform , becoming somewhat sunken, 3-8(15) per verruca; *spores* 2/ascus, uniseriate, elongate ellipsoid, rough (sensu Dibben 1980: 10), 110-160(-175) μm long, 35-50 μm wide.

Chemistry: K-, KC-, C-, Pd+ orange-red; protocetraric acid with traces of lichexanthone and virensic acid.

Additional specimens examined.
PAPUA NEW GUINEA. Morobe Province, Heads Hump logging area, 4 km ESE of Bulolo, 7°13'S, 146°14'E, alt. 780 m, *J. A. Elix 11896*, 3.xii.1982 (ANUC). AUSTRALIA. New South Wales, Olney State Forest, ca. 25 km W of Morisset, 33°07'S, 151°12'E, alt. ca. 200 m, *A. Archer P167*, 17.v.1991 (NSW); E side of Mooney Mooney Creek, ca. 8 km WSW of Gosford, 33°26'S, 151°15E, alt. 10 m, on *Casuarina*, *A. Archer P177* , 24.v.1991 (NSW); 2 km S of Booral, 32°30'S, 151°59'E, alt. 50 m, in dry sclerophyll forest, *A. Archer P186*, 19.vi.1991 (NSW).

The holotype of *P. thwaitesii* is one of a number of *Pertusaria* specimens collected by G. H. K. Thwaites, Director of the Royal Botanic Gardens, Peradeniya, Ceylon and reported by Leighton in a paper read to the Linnean Society in London on January 21st. 1869 (Leighton 1869). The specimen was originally identified as *P. albidella* Nyl., a two-spored species described from Colombia (Nylander 1863) which contains no lichen compounds (Dibben 1975:493). The holotype of *P. thwaitesii* is labelled "Getrennt von *Pertusaria albidella*" by Müller who also renamed six of the nine species listed by Leighton; the holotypes of four of these species have Leighton's numbers and references to his paper, suggesting that they are the actual specimens referred to by Leighton and therefore collected before 1869 by Thwaites. However the six specimens renamed by Müller (including those cited under *Pertusaria ceylonica*, supra) are labelled"Thwaites 1876" and it is not clear whether this is a misprint for 1867 or is the date on which Müller received the specimens, presumably from Leighton.

Protocetraric acid was identified in the holotype of *P. thwaitesii* by D. D. Awasthi and P. Srivastava (in sched. 1988); Australian specimens were found to contain traces of lichexanthone and virensic acid in addition to the major compound, protocetraric acid. *P. thwaitesii* resembles the Australian species *P. hartmannii* Müll.Arg. (Müller 1882) but is distinguished from that species by spore morphology and chemistry. *P. hartmannii* has two smooth spores per ascus and contains norstictic and perlatolic acids (Archer 1991).

P. thwaitesii is characterised by the off-white thallus, the conspicuous flattened, multi-ostiolate verrucae, two rough spores per ascus and the presence of protocetraric acid, giving a Pd+ orange-red reaction. It occurs in Sri Lanka, Papua New Guinea and, in eastern Australia, in Queensland, New South Wales and Victoria.

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NEW AND NOTEWORTHY SPECIES OF APHYLLOPHORALES (BASIDIOMYCOTINA) FROM THE CANARY ISLANDS.

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Abstract. A study of the wood-inhabiting Aphyllophorales of the evergreen *Laurus* forest and mixed *Laurus* forest ("Monteverde") of the Canary Islands is underway. Preliminary results are presented. Seventy seven (77) species are reported for the first time in this Archipelago.

Key words: Fungi, Aphyllophorales, Canary Islands.

INTRODUCTION

We are presenting the preliminary results of an evaluation study dealing with the Aphyllophorales of the *Laurus* forest and mixed *Laurus* forest ("Monteverde") of the Canary Islands. These results are part of a broader work submited by the first author as her Doctoral Thesis (RODRÍGUEZ-ARMAS, 1990). Seventy seven species are reported for the first time as being present in this Archipelago.

Recently, HALLENBERG (1991) tested the pairing behavior of some Aphyllophorales, of which twenty two (22) species were collected from the Canary Islands. These species are also reported here.

It is known that Aphyllophorales are the most effective living biotransformers of cellulose and lignin of woody residues. Their numerical and ecological importance in the Canarian "Monteverde" made a thorough study desirable.

The forests community of the Canary Islands are essentially represented by "Monteverde" (laurisilva-fayal-brezal) and pine forests (*Pinus canariensis* forests). Respectively, they are located on the thermocanarian and mesocanarian bioclimatic belts (thermotypes), with humid-subhumid and dry ombrictypes.

The laurisilva s.l. (*Ixantho-Laurion azoricae*) is an evergreen and physiognomically uniform forest, that can be found on the sides of moderate slopes (*Lauro-Perseetum indicae*), and in the deepest parts of packed ravines or ample terraces close to the bed, with humid and well developed soils (*Athyrio-Ocoteetum foetentis*). Finally, a thermofilic variant community of the Laurel forest can be present on the xeric slopes of lower levels.

The fayal-brezal (*Fayo-Ericion arboreae*) constitutes the other component of the "Monteverde". It is an evergreen shrubby-arboreal formation, growing from the climatic and edaphic points of view, in the most unfavorable places.

In the highest limit of the "Monteverde" there is a climatic inversion, which is a reason for the presence of the pine forest (*Cisto-Pinion canariensis*) here. This is a xeric and floristically poor formation where *Pinus canariensis* dominates. In the northern exposures the pine forest can descend to form the ecotonic communities with the fayal-brezal (pinar-fayal-brezal).

Although the mayority of Aphyllophorales listed in this work were collected in the "Monteverde", several were found in the border areas of the mixed pine forest (fayal-brezal-pinar), where the separation between fayal-brezal and fayal-brezal-pinar is difficult to establish.

The classification by DONK (1964) has been applied here to list the taxa. However, for practical purposes families, genera and species are shown in alphabetical order.

The type of plant community and susbtrate of each taxon are indicated. For the lignicolous fungi (the largest recorded), the specific name of the susbtrate is indicated whenever identification was possible. We only documented "dead wood, not identified [d.w. (n.i.)]" if identification of the susbtrate could not be carried out; even so this has a wide meaning (trunks, logs, branches, etc., at different stages of decomposition).

Fifty eight (58) species of Corticiaceae are reported in this paper and all but one (*Sistotrema biggsiae*) have been found in Europe. Still, seven (7) of the species cited here have not been detected in North Europe, which can be regarded as a well investigated area. These seven species are *Gloeocystidiellum clavuligerum, Parvobasidium cretatum, Peniophora boidinii, P. meridionalis, P. versicolor, Phlebiella ardosiaca, Scytinostroma aluta*. All of these species have a southern distribution in Europe or are extremely rare.

All the exsiccata are deposited in the Herbarium TFC, Mycological Section (here called TFC Mic.) of the University of La Laguna, and several duplicates of them have been sent to other herbaries, a point which is indicated in each case.

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AURISCALPIACEAE Maas Geest.

Gloeodontia columbiensis Burt ex Burds. & Lomb., in Burdsall & Lombard, Mem. N. Y. Bot. Gnd. 28: 17, 1976.
HABITAT AND SUBSTRATA.- Laurisilva s.l. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Los Silos (GB 11182, duplic. in TFC Mic. 5825).
REMARKS.- Commented by HALLENBERG (1991).

CONIOPHORACEAE Ulbr.

Coniophora fusispora (Cke & Ell.) Cke in Sacc., Syll. Fung. 6 p. 650, 1888.
HABITAT AND SUBSTRATA.- In fayal-brezal shrubby with *Pinus radiata*. On d.w. of *Pinus radiata*.
DISTRIBUTION IN THE CANARY ISLANDS.- Gomera: Garajonay National Park (TFC Mic. 5383).

Leucogyrophana mollusca (Fr.) Pouz., Ceská Mykol. 12(1): 33, 1958.
HABITAT AND SUBSTRATA.- Pinar-fayal-brezal. On bark of *Pinus canariensis*.
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: SW of La Guancha (O, duplic. in TFC Mic. 4752, 4753). La Palma: Near Sta. Cruz de La Palma (O, duplic. in TFC Mic. 4520).

CORTICIACEAE Herter

Aleurodiscus aurantius (Pers.: Fr.) Schroeter, in Cohn, Krypt.-Fl Schlesien 3 (1): 429, 1888.
HABITAT AND SUBSTRATA.- Laurisilva s.l.; fayal-brezal; pinar-fayal- brezal. On d.w. of *Erica arborea, Laurus azorica, Persea indica*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (TFC Mic. 5538, 5945). Tacoronte (TFC Mic. 5070). Hierro: Near El Brezal (O, duplic. in TFC Mic. 3995). Monteverde of El Golfo (TFC Mic. 3257, duplic. in O). La Palma: Los Sauces (TFC Mic. 3894).

Athelia epiphylla Pers., Mycol. Eur. 1: 84, 1822.
HABITAT AND SUBSTRATA.- Fayal-brezal arboreus and humid, with *Picconia excelsa, Visnea mocanera* and *Arbutus canariensis*, etc. On fallen leaves of *Arbutus canariensis*.
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Güimar (TFC Mic. 5456).

Botryobasidium botryosum (Bres.) John Erikss., Symb. Bot. Upsal. 16 (1): 53, 1958.
HABITAT AND SUBSTRATA.- Laurisilva; pinar-fayal-brezal. On living crop out roots of *Myrica faya*, and on d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (TFC Mic. 5057, duplic. in O). La Palma: Los Sauces (TFC Mic. 3446).

Botryobasidium conspersum John Erikss., Symb. Bot. Upsal. 16(1): 133, 1958.

The colonies of the conidial stage (*Haplotrichum conspersum* (Pers.) Hol.-Jech.) are effused, grey-whitish, finally brownish. Conidiophores not ramified (-200 μm). Conidiospores ellipsoidal, yellowish, 13-20 x 8.5-10 μm.
HABITAT AND SUBSTRATA.- Laurisilva; monospecific community of *Laurus azorica*, with several specimens of *Eucalyptus* sp. isolated (Osorio). On d.w. of *Laurus azorica*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Gran Canaria: Teror (TFC Mic. 5416, Conidial stage!). TENERIFE: Los Silos (GB 11161, Conidial stage!, duplic. in

TFC Mic. 5816).
REMARKS.- The perfect stage has not been observed.

Botryohypochnus isabellinus (Fr.) John Erikss., Svensk. Bot. Tidskr. 52(1): 2, 1958.
HABITAT AND SUBSTRATA.- Fayal-brezal. On bark of *Myrica faya*.
DISTRIBUTION IN THE CANARY ISLANDS.- Gran Canaria: Moya (O, duplic. in TFC Mic. 4504).

Ceraceomyces tessulatus (Cke) Jülich, Willdenowia Beih.7: 154, 1972.
HABITAT AND SUBSTRATA.- Laurisilva in the bed of a ravine; fayal-brezal arboreus and humid, with abundant lichenic and bryophytic epiphytism. On d.w. of *Erica arborea* and *Castanea sativa*.
DISTRIBUTION IN THE CANARY ISLANDS.- Gomera: Garajonay National Park (TFC Mic. 5682). La Palma: Los Sauces (TFC Mic. 3364).

Cristinia gallica (Pilat) Jülich, Persoonia 8: 298, 1975.
HABITAT AND SUBSTRATA.- Laurisilva s.l. On dead branch of *Myrica faya*, *Laurus azorica*, and on dead bark of *Ocotea foetens* with soil, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (TFC Mic. 5521, 5533). La Palma: Los Sauces (TFC Mic. 3872, duplic. in O).

Cristinia helvetica (Pers.) Parm., Consp. Syst. Cort.: 48, 1968.
HABITAT AND SUBSTRATA.- Laurisilva. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.-Tenerife: Los Silos (GB 11111, duplic. in TFC Mic. 5821).

Cytidiella albomellea (Bond.) Parm., Consp. Syst. Cort.: 101, 1968.
HABITAT AND SUBSTRATA.- Fayal-brezal arboreus and humid, with *Picconia excelsa, Visnea mocanera* and *Arbutus canariensis*, etc. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Güimar (TFC Mic. 5448, duplic. in O).

Dacryobolus sudans (Alb. & Schwein.: Fr.) Fr., Summa Veg. Scand. 2: 404, 1849.
HABITAT AND SUBSTRATA.- Laurisilva s.l.; fayal-brezal. On living trunk of *Laurus azorica*, fallen branch of *Myrica faya*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Hierro: Near El Brezal (O, duplic. in TFC Mic. 3992). Monteverde of El Golfo (TFC Mic. 3237, 3256, duplic. in O). La Palma: Breña Alta (TFC Mic. 3378).
REMARKS.- Commented by HALLENBERG (1991).

Fibulomyces septentrionalis (John Erikss.) Jülich, Willdenowia Beih.7: 187, 1972.
HABITAT AND SUBSTRATA.- Laurisilva s.l. On living stem of *Bystropogon canariensis* var. *smithianus*.
DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Breña Alta (TFC Mic. 3383).

Globulicium hiemale (Laurila) Hjortstam, Svensk Bot. Tidskr. 67(2): 108, 1973.
HABITAT AND SUBSTRATA.- Laurisilva s.l.; fayal-brezal; fayal-brezal with *Erica scoparia* subsp. *platycodon*; fayal-brezal arboreus and humid, with abundant lichenic and bryophytic epiphytism; pinar-fayal-brezal. On fallen branch of *Erica arborea*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (TFC Mic. 5025). Gomera: Garajonay National Park (TFC Mic. 5722, 5724). Hierro: Monteverde of El Golfo (TFC Mic. 3227). La Palma: Los Sauces (TFC Mic. 3466, 3528).

Gloeocystidiellum clavuligerum (Höhn. & Litsch.) Nakasone, Mycotaxon 14(1): 320, 1982.
HABITAT AND SUBSTRATA.- Laurisilva. On d.w. of *Persea indica*.
DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Puntallana (TFC Mic. 3611).
REMARKS.- Commented by HALLENBERG (1991).

Gloeocystidiellum luridum (Bres.) Boidin, Compt.-Rend. Hebd. Séances Acad. Sci. 233: 1668, 1951.
HABITAT AND SUBSTRATA.- Laurisilva s.l.; fayal-brezal with several cut specimens of *Eucalyptus*. On decaying wood of *Laurus azorica*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Gomera: Garajonay National Park (TFC Mic. 5721). La Palma: Los Sauces (TFC Mic.3322, duplic. in O). Garafía (TFC Mic. 3733).

Gloeocystidiellum porosum (Berk. & .Curt.) Donk, Medd. Nederl. Mycol. Ver. 18-20: 156, 1931.
HABITAT AND SUBSTRATA.- Laurisilva s.l. On dead branches of *Persea indica*, *Ocotea foetens, Laurus azorica, Persea indica, Rubus inermis*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Los Silos (GB 11185). Tacoronte (TFC Mic. 5068, 5087). La Palma: Los Sauces (TFC Mic. 5494, 3362, duplic. in O).

Hyphoderma argillaceum (Bres.) Donk, Fungus 27(1-4): 14, 1957.
HABITAT AND SUBSTRATA.- Laurisilva in bed of a ravin. On fallen trunks of *Laurus azorica*, d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Los Silos (GB 11170). La Palma: Los Sauces (TFC Mic. 417).

Hyphoderma mutatum (Peck) Donk, Fungus 27(1-4): 15, 1957.
HABITAT AND SUBSTRATA.- Laurisilva. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Los Silos (GB 11094, duplic. in TFC Mic. 5826).

Hyphoderma roseocremeum (Bres.) Donk, Fungus 27(1-14): 15, 1957.
HABITAT AND SUBSTRATA.- Laurisilva. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Gomera: Garajonay National Park (GB 11134, duplic. in TFC Mic. 5827).

REMARKS.- Commented by HALLENBERG (1991).

Hyphoderma setigerum (Fr.) Donk, Fungus 27(1-14): 15, 1957.
HABITAT AND SUBSTRATA.- Laurisilva. On d.w. of *Ilex canariensis*.
DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Los Sauces (TFC Mic. 3818, duplic. in O).

Hyphodontia juniperi (Bourdot & Galzin) John Erikss. & Hjortstam in John Erikss. & Ryv., Cort. North Europe 4: 666, 1976.
HABITAT AND SUBSTRATA.- Fayal-brezal arboreus and humid, with *Persea indica* and *Rhamnus glandulosa*, etc. On dead trunks, branches, etc. of these trees.
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Güimar (TFC Mic. 5464, duplic. in O).

Hyphodontia nespori (Bres.) John Erikss. & Hjortstam in John Erikss. & Ryv., Cort. North Europe 4: 655, 1976.
HABITAT AND SUBSTRATA.- Laurisilva s.l.; fayal-brezal humid with abundant lichenic and bryophytic epiphytism; fayal-brezal with *Pinus canariensis*. On w.d. of *Erica arborea* and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (O, duplic.in TFC Mic. 4510). Ibid. (TFC Mic. 5541, 5005, 5031). Ibid. (GB 10955, duplic. in TFC Mic. 5829). Gomera: Garajonay National Park (GB 11132, duplic. in TFC Mic. 5830). La Palma: Garafía (TFC Mic. 3658).
REMARKS.- Commented by HALLENBERG (1991).

Hyphodontia spathulata (Schrader: Fr.) Parm., Consp. Syst. Cort.: 123, 1968.
HABITAT AND SUBSTRATA.- Fayal-brezal; fayal-brezal with several specimens of *Eucalyptus* sp. isolated and *Ocotea foetens*. On decaying trunk of *Ocotea foetens*.
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (O, duplic. in TFC Mic. 4513, 4514). Gomera: Garajonay National Park (TFC Mic. 5315, duplic. in GB).

Hyphodontia subalutacea (P.Karst.) John Erikss., Symb. Bot. Upsal. 16(1): 104, 1958.
HABITAT AND SUBSTRATA.- Laurisilva. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: (Monte de La Esperanza, pine forest, GB 10983, 11195, duplic. in TFC Mic. 5831 and 5832). Gomera: Garajonay National Park (GB 11150).
REMARKS.- Commented by HALLENBERG (1991).

Hypochniciellum subillaqueatum (Litsch.) Hjortstam, Mycotaxon 12 (1): 177, 1980.
HABITAT AND SUBSTRATA.- Fayal-brezal with *Pinus canariensis*. On bark of dead pine.
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (O, duplic. in TFC Mic. 4522).

Hypochnicium eichleri (Bres.) John Erikss. & Ryv., Cort. North Europe 4: 707, 1976.
HABITAT AND SUBSTRATA.- Laurisilva. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Gomera: Garajonay National Park (GB 11149).
REMARKS.- Commented by HALLENBERG (1991).

Hypochnicium vellereum (Ell. & Cragin) Parm., Consp. Syst. Cort.: 116, 1968.
HABITAT AND SUBSTRATA.- Fayal-brezal arboreus with abundant presence of *Laurus azorica* and *Persea indica*. On trunk of *Persea indica*.
DISTRIBUTION IN THE CANARY ISLANDS.- Gomera: Garajonay National Park (TFC Mic. 5355, duplic. in O).

Leptosporomyces raunkiaerii (M.P.Christ.) Jülich, Willdenowia Beih. 7: 206, 1972.
HABITAT AND SUBSTRATA.- Fayal-brezal arboreus and humid, with *Picconia excelsa, Visnea mocanera* and *Arbutus canariensis*, etc. Epiphyllous, on leaves of *Arbutus canariensis*.
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Güimar (TFC Mic. 5453; 5454, duplic. in O).

Mycoacia aurea (Fr.) John Erikss. & Ryv., Cort. North Europe 4: 877, 1976.
HABITAT AND SUBSTRATA.- Laurisilva in bed of a ravin; fayal-brezal shrubby with several specimens of *Eucalyptus* sp. isolated and *Castanea sativa* on the bottom. On fallen log of *Myrica faya*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Gomera: Garajonay National Park (TFC Mic. 5335). La Palma: Los Sauces (TFC Mic. 3870).

Mycoacia fuscoatra (Fr.: Fr.) Donk, Medd. Neder. Mycol. Ver.18-20: 150, 1931.
HABITAT AND SUBSTRATA.- Fayal-brezal arboreus and humid, with abundant lichenic and bryophytic epiphytism; fayal-brezal with *Ocotea foetens*. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Gran Canaria: Moya (TFC Mic. 3828). Gomera: Garajonay National Park (TFC Mic. 5687, duplic. in O).

Mycoacia uda (Fr.) Donk, Medd. Neder. Mycol. Ser. 18-20: 150, 1931.
HABITAT AND SUBSTRATA.- Laurisilva s.l.; fayal-brezal. On fallen branches of *Myrica faya* and *Persea indica*.
DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Los Sauces (TFC Mic. 3765). Garafía (TFC Mic. 3692).

Parvobasidium cretatum (Bourdot & Galzin) Jülich, Persoonia 8(3): 302, 1975.
HABITAT AND SUBSTRATA.- Laurisilva of slopes, near the bed of a ravine. On dead rachis of *Woodwardia radicans*.
DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Los Sauces (TFC Mic. 5640, duplic. in GB).

Peniophora boidinii Reid, Rev. Biol., Lisboa 5: 146, 1965.
HABITAT AND SUBSTRATA.- Laurisilva in the bed of a ravine. On fallen trunk of

Laurus azorica.
DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Puntallana (TFC Mic. 3622, duplic. in GB).

Peniophora lycii (Pers.) Höhn. & Litsch., Sitzungsber Kaiserl. Akad. Wiss. Math.-Naturwiss. Cl., Abt. 1, 116: 747, 1907.
HABITAT AND SUBSTRATA.- Laurisilva s.l.; fayal-brezal arboreus and humid, with abundant lichenic and bryophytic epiphytism; fayal-brezal with presence of *Ocotea foetens, Picconia excelsa, Persea indica* and *Rhanmus glandulosa*, etc.; fayal-brezal with *Pinus radiata*; fayal- brezal with *Pinus canariensis* and several specimens of *Eucalyptus* sp. isolated; pinar-fayal-brezal. On fallen branches of*Castanea sativa, Chamaecytisus proliferus* var. *palmensis, Erica arborea, Eucalyptus* sp., *Gesnouinia arborea, Ilex canariensis, Laurus azorica, Myrica faya, Ocotea foetens, Pinus canariensis, Rubus inermis*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Gran Canaria: Moya (O 170/76, duplic. in TFC Mic. 4777). Fontanales (TFC Mic. 5803). Tenerife: Anaga (TFC Mic. 5506, 3737, 4955). Icod del Alto (TFC Mic. 4982, 4983). Güimar (TFC Mic. 5452). Tacoronte (TFC Mic. 4990). Gomera: Garajonay National Park (TFC Mic. 5718, 5705). Hierro: Monteverde of El Golfo (TFC Mic. 3325, 3327). La Palma: Los Sauces (TFC Mic. 3326). Ibid. (TFC Mic. 3921). Barlovento (TFC Mic. 3479). Garafía (TFC Mic. 3674, duplic. in GB). Garafía (TFC Mic. 3699, duplic. in GB).
REMARKS.- Commented by HALLENBERG (1991).

Peniophora meridionalis Boidin, Bull. Soc. Mycol. France 74 (4): 455, 1958.
HABITAT AND SUBSTRATA.- Laurisilva s.l.; fayal-brezal shrubby on slopes; fayal-brezal arboreus and very humid, with abundant lichenic and bryophytic epiphytism; fayal-brezal with *Pinus canariensis* isolated; fayal-brezal with *Castanea sativa*; pinar-fayal-brezal. On fallen trunks and branches of *Myrica faya, Erica arborea, Pinus canariensis, Castanea sativa*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Gran Canaria: Fontanales (TFC Mic. 5806). Tenerife: Anaga (TFC Mic. 5504, 5507). Gomera: Garajonay National Park (GB 11152). Ibid. (TFC Mic. 5300, 5269). Hierro: Monteverde of El Golfo (TFC Mic. 3391). El Brezal (TFC Mic. 3220, duplic. in O; 3232). La Palma: Breña Alta (TFC Mic. 3382, duplic. in LY-14486). Garafía (TFC Mic. 3704). Los Sauces (TFC Mic. 3892; 3449, duplic. in GB 3461. Ibid., (TFC Mic. 3533, duplic. in LY-14485).
REMARKS.- Part of the material was identified by Dr. Boidin (Lyon). The spores of Canarian specimens are somewhat bigger than the measurments that BOIDIN (1958) gives in the original description of the taxon (up to 8.8 x 3.2 μm). This species is also commented by HALLENBERG (1991).

Peniophora rufomarginata (Pers.) Litsch., Keiss., Kryptog. Exs. Wien 2613, 1923.
HABITAT AND SUBSTRATA.- Laurisilva in the bed of a ravine. On living branches of *Teline stenopetala*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (GB 10941, duplic.in TFC Mic. 5836). Gomera: Garajonay National Park (TFC Mic. 5753). La Palma: Los Sauces (TFC Mic. 3768).

REMARKS.- Commented by HALLENBERG (1991).

Peniophora versicolor (Bres.) Sacc. & Sydow, Syll. Fung. 16: 193, 1902.
HABITAT AND SUBSTRATA.- Laurisilva. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (GB 11082). Gomera: Garajonay National Park (GB 11123).

Phanerochaete tuberculata (P.Karst.) Parm., Consp. Syst. Cort.: 83, 1968.
HABITAT AND SUBSTRATA.- Laurisilva s.l. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Hierro: Monteverde of El Golfo (TFC Mic. 3037).

Phlebia deflectens (P. Karst.) Ryv., Rep. Kevo Subarc. Res. Stat. 8: 150, 1971.
HABITAT AND SUBSTRATA.- Fayal-brezal; pinar-fayal-brezal. On dead trunk of *Laurus azorica*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (TFC Mic. 4964, duplic. in O). La Palma: Near Sta. Cruz de La Palma (O, duplic. in TFC Mic. 4534).

Phlebia radiata Fr., Syst. Mycol. 1: 427, 1821.
HABITAT AND SUBSTRATA.- Xeric laurisilva, with several pines. On fallen branch of *Pinus canariensis*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (O, duplic. in TFC Mic. 4632). La Palma: Garafía (TFC Mic. 3742).

Phlebiella ardosiaca (Bourdot & Galzin) Larsson & Hjortstam in Hjortstam & Larsson, Mycotaxon 29: 316, 1987.
HABITAT AND SUBSTRATA.- Laurisilva; fayal-brezal; fayal-brezal with *Eucalyptus* sp. On fallen trunks of *Eucalyptus* sp. and *Ocotea foetens*.
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (GB 11087, duplic. in TFC Mic. 5839). Gomera: Garajonay National Park (TFC Mic. 5273). La Palma: Barlovento (TFC Mic. 3494, duplic. in GB).

Phlebiella grisella (Bourdot) Larsson & Hjortstam in Hjortstam & Larsson, Mycotaxon 29: 318, 1987.
HABITAT AND SUBSTRATA.- Laurisilva. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (TFC Mic. 4957, duplic. in GB).

Resinicium bicolor (Alb. & Schwein.: Fr.) Parm., Consp. Syst. Cort.: 97, 1968.
HABITAT AND SUBSTRATA.- Laurisilva s.l.; laurisilva in the bed of a ravine, with several specimens of *Pinus canariensis* isolated; fayal- brezal. On fallen trunk of *Pinus canariensis*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (TFC Mic. 5035, 5039). La Palma: Garafía (TFC Mic. 3678, 3669).

Scytinostroma alutum Lanquetin, Bull. Mens. Soc. Linn. Soc. Bot. Lyon 53(5): 187, 1984.
HABITAT AND SUBSTRATA.- Laurisilva; fayal-brezal with *Erica scoparia* subsp. *platycodo*n. On living branches and fallen trunk of *Myrica faya* and *Ocotea foetens*.
DISTRIBUTION IN THE CANARY ISLANDS: Gomera: Garajonay National Park (TFC Mic. 5684, 3855). La Palma: Los Sauces (TFC Mic.3375, Duplic.in LY).
REMARKS.- The specimen of Gomera is in agreement with the original description of this species; however, that of La Palma is somewhat different. Dr. Lanquetin (Lyon) has studied this material, and comments that it could be *S. alutum*, or even *S.duriusculum*, but it will be necessary to observe the size of the gloeocystidia and its frequency in fresh material, and the measurment of the spores in a spore-print. Nevertheless, nearly all of the characters agree with the original description of *S. aluta* (LANQUETIN, 1984).

Sistotrema biggsiae Hallenb., Mycotaxon 21: 401-403, 1984.
HABITAT AND SUBSTRATA.- Laurisilva. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Gomera: Garajonay National Park (GB 11148, duplic. in TFC Mic. 5841)
REMARKS.-This species in not recorded in the European bibliography. HALLENBERG (1984) described the species on material from N. America but did not make reference about the presence of the taxon in Europe.

Sistotrema brinkmannii (Bres.) John Erikss., Kungl. Fysiogr. Sällsk. Lund. Förh. 18(8): 17, 1948
HABITAT AND SUBSTRATA.- Xeric laurisilva; pine forest. On decaying wood of *Laurus azorica* and *Pinus canariensis*.
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Monte de La Esperanza (GB 11200, duplic. in TFC Mic. 5842). La Palma: Los Sauces (TFC Mic. 3814).

Sistotrema muscicolum (Pers.) Lundell in Lundell & Nannf., Fung. Exs. Suec. 39-40: 11 (nº 1415a), 1947.
HABITAT AND SUBSTRATA.- Laurisilva; fayal-brezal on slopes with *Pinus radiata*. Terricolous and on fallen log of *Laurus azorica*.
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Tacoronte (TFC Mic. 5076). La Palma: Garafía (TFC Mic. 3739, duplic. in GB).

Sistotrema oblongisporum M.P.Christ. & Hauerslev, in M.P.Christ., Dansk Bot. Ark. 19(2): 82, 1960.
HABITAT AND SUBSTRATA.- Laurisilva with several specimens of *Eucalyptus* sp. isolated. On fallen trunk of *Eucalyptus* sp.
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (GB 10935, 10933, duplic. in TFC Mic. 5844, 5845).
REMARKS.- Commented by HALLENBERG (1991).

Sistotrema pteriphilum Larsson & Hjortstam, Windahlia 15: 56, 1986.
HABITAT AND SUBSTRATA.- Pinar-fayal-brezal. On decaying branch of *Pinus canariensis*.

DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Los Sauces (TFC Mic. 3873, duplic. in GB).

Sistotremella perpusilla Hjortstam, in John Erikss. et al., Cort. North Europe 7: 1381, 1984.
HABITAT AND SUBSTRATA.- Laurisilva. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Los Silos (GB 11114, 11117, duplic. in TFC Mic. 5848, 5849).

Subulicystidium longisporum (Pat.) Parm., Consp. Syst. Cort.: 121, 1968.
HABITAT AND SUBSTRATA.- Fayal-brezal. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Los Realejos (TFC Mic. 5907).

Trechispora alnicola (Bourdot & Galzin) Liberta, Taxon 15: 318, 1966.
HABITAT AND SUBSTRATA.- Laurisilva s.l.; fayal-brezal with high presence of *Ocotea foetens*; monospecific community of *Laurus azorica*, with several specimens of *Eucalyptus* sp. isolated (Osorio). On fallen trunk and branches of *Laurus azorica, Ocotea foetens, Picconia excelsa,* and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Gran Canaria: Moya (TFC Mic. 5769; 5768, duplic. in GB). Teror (TFC Mic. 5812, duplic. in GB). La Palma: Los Sauces (TFC Mic. 3805). Puntallana (TFC Mic. 3634, duplic. in GB). Garafía (TFC Mic. 3746, duplic. in GB).

Trechispora microspora (P.Karst.) Liberta, Taxon 15(1): 319, 1966.
HABITAT AND SUBSTRATA.- Laurisilva s.l. On decaying wood of *Erica arborea.*
DISTRIBUTION IN THE CANARY ISLANDS.- Hierro: Monteverde of El Golfo (TFC Mic. 3292).

Tubulicium vermiferum (Bourdot) Oberw., Sydowia 19(1-3): 54, 1965.
HABITAT AND SUBSTRATA.- Laurisilva s.l. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (GB 11066, duplic. in TFC Mic. 5854). Hierro: Monteverde of El Golfo (TFC Mic. 3390).

Tubulicrinis accedens (Bourdot & Galzin) Donk, Fungus 26(1-4): 14, 1956.
HABITAT AND SUBSTRATA.- Laurisilva. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (TFC Mic. 5030).

Tubulicrinis sororius (Bourdot & Galzin) Oberw., Z. Pilzk. 31(1-2): 23, 1965.
HABITAT AND SUBSTRATA.- Fayal-brezal arboreus and humid, with high presence of *Persea indica, Rhamnus glandulosa,* and *Pinus canariensis* isolated. On decaying strobile of *Pinus canariensis.*
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Güimar (TFC Mic. 5461, duplic. in O).

Vuilleminia cystidiata Parm., Izv. Akad. Nauk Estonsk. SSR, Ser. Biol. 14(2): 232, 1965.
HABITAT AND SUBSTRATA.- Laurisilva s.l. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (GB 11002, duplic. in TFC Mic. 5859).
REMARKS.- Commented by HALLENBERG (1991).

Xenasma pruinosum (Pat.) Donk, Fungus, 27(1-4): 25, 1957.
HABITAT AND SUBSTRATA.- Laurisilva s.l. On dead branch of *Rubus inermis*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (TFC Mic. 4977). Gomera: Garajonay National Park (GB 11127, duplic. in TFC Mic. 5860).

HYMENOCHAETACEAE Donk

Asterostroma cervicolor (Berk. & M.A.Curtis) Massee, J. Linn. Soc. Bot. 25: 155, 1890 [1889].
HABITAT AND SUBSTRATA.- Laurisilva s.l. Terricolous.
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (GB 11054).

Hymenochaete tabacina (Sow.: Fr.) Lév., Ann. Sci. Nat. III (5) Bot.: 152, 1846.
HABITAT AND SUBSTRATA.- Laurisilva s.l. On fallen branches of *Erica arborea*.
DISTRIBUTION IN THE CANARY ISLANDS.- Hierro: Monteverde of El Golfo (TFC Mic. 3243, duplic. in LY).
REMARKS.- The identification of the material was made by Dr. Lèger (Lyon). The specimen collected in the Canary Islands is resupinate, but the fruitbody can also be semipileate (stereoid-type).

Phellinus contiguus (Fr.) Pat., Ess. Tax. p. 97, 1900.
HABITAT AND SUBSTRATA.- Laurisilva s.l. On fallen branch (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (GB 11029, duplic. in TFC Mic. 6220).

Phellinus rufus (Bres.) Ryv., Mycotaxon 33: 321, 1988.
HABITAT AND SUBSTRATA.- Laurisilva s.l.; fayal-brezal with *Eucalyptus* sp. On living trunk of *Erica arborea*, decaying logs of *Myrica faya* and *Laurus azorica*.
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Tacoronte (O, duplic. in TFC Mic. 4806). Anaga (TFC Mic. 6031, 6032). Ibid., (GB 11952, duplic. in TFC Mic. 4536). Los Silos (TFC Mic. 6016). Sine loc. (RYVARDEN, 1988). Gomera: Garajonay National Park (TFC Mic. 5739, 5659). Ibid., (GB 11154, duplic. in TFC Mic. 4537). La Palma: Puntallana (TFC Mic. 3631).
REMARKS.- New record to Gomera and La Palma. This species has hitherto only been recorded from the Canary Islands.

POLYPORACEAE Corda

Ceriporia viridans (Berk. & Br.) Donk, Meded. Bot. Mus. Herb. Rijks Univ. Utrecht 9: 171, 1933.
HABITAT AND SUBSTRATA.- Laurisilva s.l.; fayal-brezal, with *Ocotea foetens*. On decaying wood of *Ocotea foetens, Erica arborea, Laurus azorica*, on fallen leaves of *Myrica faya*, and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Gran Canaria: Moya (TFC Mic. 5780).Tenerife: Anaga (TFC Mic. 4961). Hierro: Monteverde of El Golfo (TFC Mic. 3036, duplic. in O).

Cerrena unicolor (Bull.: Fr.) Murr., J. Mycol. 9: 91, 1903.
HABITAT AND SUBSTRATA.- Laurisilva. On fallen trunk of *Laurus azorica*.
DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Garafía (TFC Mic. 3715, duplic. in O).

Heterobasidion annosum (Fr.) Bref., Unters. Gesamtg. Mykol. 8: 154, 1888.
HABITAT AND SUBSTRATA.- Pinar-fayal-brezal. On cut trunk of *Pinus canariensis*.
DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Los Sauces (TFC Mic. 3368).

Irpex lacteus (Fr.: Fr.) Fr., Elench. Fung. 1: 145, 1828.
HABITAT AND SUBSTRATA.- Fayal-brezal. On d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Los Sauces (TFC Mic. 3370).

Oligoporus balsameus (Peck) Gilbn.& Ryv., Mycotaxon 22(2): 364, 1985.
HABITAT AND SUBSTRATA.- Fayal-brezal arboreus. On d.w. of *Erica arborea*.
DISTRIBUTION IN THE CANARY ISLANDS.- Gomera: Garajonay National Park (TFC Mic. 5402, duplic. in O).

Rigidoporus ulmarius (Sow.: Fr.) Imazeki, Bull. Govt. Exp. Sta. Meguro 57: 119, 1952.
HABITAT AND SUBSTRATA.- Laurisilva. On living trunk of *Ocotea foetens*.
DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Los Sauces (TFC Mic. 3374, 3869)

Schizopora radula (Pers.: Fr.) Hallenb., Mycotaxon 18(2): 308, 1983.
HABITAT AND SUBSTRATA.- Laurisilva s.l.; fayal-brezal arboreus and humid, with abundant lichenic and bryophytic epiphytism; fayal-brezal shrubby, with several specimens of *Eucalyptus* sp. isolated, and *Castanea sativa* at the bottom of the ravine; monospecific community of Laurus azorica with *Eucalyptus* sp. (Osorio); pinar-fayal-brezal. On decaying wood of *Apollonias barbujana, Erica arborea, Eucalyptus globulus, Laurus azorica, Myrica faya, Persea indica, Pinus canariensis, Prunus lusitanica* subsp. *hixa, Ocotea foetens*, and d.w. (n.i.).

DISTRIBUTION IN THE CANARY ISLANDS.- Gran Canaria: Moya (TFC Mic. 5784, 5895). Fontanales (TFC Mic. 5899, 5901). Teror (TFC Mic.5900). Tenerife: Los Silos (TFC Mic. 3075). Ibid. (NH-GB 11102, Duplic. in TFC Mic. 5867). Los Realejos (TFC Mic. 5920). Anaga (TFC Mic. 5056, 5004, 4970). Ibid. (GB 11023, duplic. in TFC Mic. 5866). *Tacoronte (TFC Mic. 5084). Gomera: Garajonay National Park (TFC Mic. 5301, Duplic. in NH-GB). Ibid. (TFC Mic. 5324, duplic. in GB). Hierro: * Monteverde of El Golfo (TFC Mic. 3019). La Palma: Los Sauces (TFC Mic. 3891). Ibid. (TFC Mic. 3772, 3804, 3809; 3777, duplic. in GB). Garafía (TFC Mic.3738, 3657).
REMARKS.- Exsiccata with (*), correspond to specimens with intermediate characters between *S. radula* and *S. paradoxa* (Fr.) Donk. The two species are very close to each other. Separating characters, at least valid for N European specimens, are given by NIEMELÄ (1987). HALLENBERG (1991), verified the existence of *S. radula* on the Canary Islands by using intercompatibility tests, while there are no such evidences for *S. paradoxa.*

Trametes pubescens (Schum.: Fr.) Pilát, Atl. Champ. Eur. 3: 268, 1939.
HABITAT AND SUBSTRATA.- Laurisilva; fayal-brezal. On fallen branches of *Prunus lusitanica* subsp. *hixa, Persea indica,* and d.w. (n.i.).
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (TFC Mic. 5513, 5520). Los Realejos (TFC Mic. 5921). La Palma: Los Sauces (TFC Mic. 3902).

STEREACEAE Pilát

Lopharia spadicea (Pers.: Fr.) Boidin, Bull. Mens. Soc. Linn. Soc. Bot. Lyon 28(7): 211, 1959.
HABITAT AND SUBSTRATA.- Fayal-brezal arboreus on slope. On fallen branch of *Gesnouinia arborea.*
DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Los Sauces (TFC Mic. 5574, duplic. in O).

Stereum gausapatum (Fr.) Fr., Hym. Eur.: 638, 1874.
HABITAT AND SUBSTRATA.- Fayal-brezal-pinar. On fallen branch of *Myrica faya.*
DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Los Sauces (TFC Mic. 3459, duplic. in O).

Stereum subtomentosum Pouz., Ceská Mykol. 18: 147-148, 1964.
HABITAT AND SUBSTRATA.- Laurisilva s.l. On fallen branch of *Erica arborea.*
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (GB 10961, duplic. in TFC Mic. 5861).

THELEPHORACEAE Chev.

Thelephora anthocephala Fr., Syst. Mycol. 1: 430, 1821.
HABITAT AND SUBSTRATA.- Fayal-brezal-pinar. Terricoluos.

DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Los Sauces (TFC Mic. 5154).

Tomentella terrestris (Berk. & Br.) M.J. Larsen, Mycol. Mem. 4: 105, 1974.
HABITAT AND SUBSTRATA.- Pinar-fayal-brezal. On fallen trunk of *Myrica faya*.
DISTRIBUTION IN THE CANARY ISLANDS.- La Palma: Los Sauces (TFC Mic. 3442, Duplic. in WIS).

Tomentellastrum floridanum (Ell. & Ev.) M.J. Larsen, Mycol. Mem. 4: 116, 1974
HABITAT AND SUBSTRATA.- Fayal-brezal with planting *Pinus canariensis*. On decaying trunk of *Laurus azorica*.
DISTRIBUTION IN THE CANARY ISLANDS.- Tenerife: Anaga (O, duplic. in TFC Mic. 4647).

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HALLENBERG, N., 1984. A taxonomic analysis of the *Sistotrema brinkmannii* complex (Corticiaceae, Basidiomycetes). Mycotaxon 21(2): 389-411.

HALLENBERG, N., 1991. Pairing tests with species of Aphyllophorales (Basidiomycetes) from two phytogeographically isolated areas. Mycotaxon 42: 355-386.

LANQUETIN, P., 1984. *Scytinostroma aluta* nov.sp. (Basidiomycetes Lachnocladiaceae). Bull. Soc. Linn. Lyon 5: 187-189.

NIEMELÄ, T., 1987. The raduloid species of *Schizopora* Beiträge zur Kenntnis der Pilze Mitteleuropas. 3: 365-370. Arbeitsgemeinschaft Mykologie Ostwürttemberg (AMO).

RODRIGUEZ-ARMAS, J.L., 1990. Contribución al estudio de los Aphyllophorales del monteverde y comunidades mixtas de transición de fayal-brezal-pinar de Canarias. Universidad de La Laguna. Tesis Doctoral (unpubl.).

RYVARDEN, L., 1988. Type studies in the Polyporaceae. 20. Species described by G.Bresadola. Mycotaxon 33: 303-327.

MYCOTAXON

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FUNGI FROM *YUCCA BACCATA*. 2. *PLANISTROMA OBTUSILUNATUM* sp. nov., AND ITS ANAMORPH, *PIPTARTHRON UNILOCULARE* sp. nov.

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Planistroma obtusilunatum, the second species described in the genus, is characterized and the life cycle described. Its anamorph is a new species, *Piptarthron uniloculare*, a fungus that has previously been mistaken for *Stagonospora gigantea* on *Yucca*. *Stagonospora gigantea* is redescribed from the type material.

Introduction

While *Piptarthron pluriloculare* Ramaley and its teleomorph, *Planistroma yuccigena* Ramaley, were under investigation (7), a morphologically similar fungus from *Yucca baccata* Torrey was frequently collected in southwestern Colorado. This fungus had large, dark, thick-walled, unilocular conidiomata, and large, hyaline, septate, cylindrical, bluntly rounded conidia. It was tentatively identified as *Stagonospora gigantea* Heald and Wolf (4) which is reported (3) on several species of *Yucca* in the United States. However, this designation of the unknown fungus was troublesome because the conidiomata had a cup-shaped wall with the upper portion composed of columnar arrays of cells, similar to *Piptarthron* and *Kellermania*, but not typical of *Stagonospora*. Also, the conidia were shaped differently and were smaller than described for *S. gigantea*. The fungus was clearly not *Kellermania*, which has apically appendaged conidia, nor did it seem to belong to *Piptarthron* which is more or less multilocular. However, when features of the unknown anamorph and closely related coelomycetes were considered, along with characteristics of their teleomorphs, it seemed better to place it with *Piptarthron* than to establish a new, monotypic genus.

Examination of the type and other specimens of *Stagonospora gigantea* revealed that, (a) other mycologists also had called the unknown fungus *Stagonospora gigantea*, probably because of the lack of a satisfactory alternative, and, (b) the unknown fungus is not, as was suspected, a member of that taxon.

Materials and Methods

Freshly extruded conidia were suspended in a drop of sterile tap water on commercial potato dextrose agar (PDA) and the drop spread with a sterile glass rod. Single germinating conidia were isolated onto fresh PDA and grown at room temperature. Cultivation of the fungus from asci was accomplished by washing asci three times in sterile tap water and placing the washed asci on PDA. Axenic colonies were isolated to fresh PDA.

Taxonomy

Planistroma obtusilunatum, *sp. nov.* ----- Fig. 1.

Stromata fusca ad atra, subepidermalia, immersa, erumpentia, separata vel confluentia, glabra, 250-550 μm diam ubi separata, usque ad 550 μm elata, 1-5 locularia; paries crassus, cupulatus, pars supera affixa in epidermide hospitis. Stratum supremum stromatum ex columnis cellularum elongatarum compositum. Loculi ascogeni in eodem stromate ac loculi conidiogeni et/vel spermatia exorientes; asci post conidia et/vel spermatia formati. Loculi ovoidei vel globosi, unistrati, omnes ostiolati, per columnas ex cellulis brunneis, elongatis, aliquantum crassiparietibus compositis separati; textura interthecii filamentosa, cellulae cylindratae, ellipsoideae, vel irregulariter curvatae et tumescentes in extremis, plerumque 12-20 x 4-7.5 μm. Asci bitunicati, cylindrati vel subclavati, octospori, 170 x 27 μm, 270 μm ubi admodum prolongati. Ascosporae ellipsoideae ad subrhomboideae aspectu uno, curvatae, extremis obtuse rotundatis ubi 90 gradibus versae, aseptatae, hyalinae, (31-)35-45(-50) x (11-)13-14.5(-21) μm. Periphyses praesentes.

Stromata (Fig. 1, A) dark bown to black, amphigenous, subepidermal, immersed, erumpent, but a rim remaining covered by the epidermis, separate or confluent, glabrous, 250-550 μm diam when separate, up to 550 μm tall, 1-5 loculate; wall thick, cup-shaped, upper surface attached to the host epidermis, the base composed of 8-12 layers of dark-walled cells, the side walls thicker. The top layer of a stroma composed of vertical columns of elongate cells. Ascogenous locules (Fig. 1, B) developing in the same stroma as the conidial and/or spermatial locules, asci formed after production of the conidia and/or spermatia. Locules ovoid to globose, in a single layer, each with an ostiole, separated by columns of brown, rather thick-walled, elongated cells, collapsing the walls of empty conidial locules (Fig. 1, A), interthecial tissue filamentous, the cells cylindric, elliptic, or irregularly curved and swelled at the ends, mostly 12-20 x 4-7.5 μm. Asci bitunicate, cylindric or slightly clavate, 8-spored, 170 x 27 μm, 270 μm long when fully extended. Ascospores (Fig. 1, C) ellipsoid to somewhat rhomboid in one view, curved with bluntly rounded ends (obtuse-lunate) when rotated 90 degrees, aseptate, hyaline, (31-)35-45(-50) x (11-)13-14.5(-21) μm. Periphyses present.

Substrate: Leaves of *Yucca* spp.

HOLOTYPE: USA. COLORADO: La Plata County, Durango, Fort Lewis College Campus, *ex foliis emortuis Yucca baccata* Torrey, 4 April 1991, Annette Ramaley, No. 9014, UC 1475096. ISOTYPES: BPI 1110169, COLO F-18029.

Discussion

Planistroma obtusilunatum differs from the type species, *P. yuccigena*, in size of the asci, shape of the ascospores, and their distinctive anamorphs. Ascospore shape in *P. obtusilunatum* is quite different from that in three other *Planistroma* species (7, and unpublished) which are elliptic or obovate.

Colonies derived from asci had white aerial, appressed, and subsurface mycelium, and a yellow reverse. Conidiomata contained typical *Piptarthron uniloculare* conidia.

Anamorph: **Piptarthron uniloculare,** *sp. nov.*-----Fig. 2, A-F.

Conidiomata subepidermalia, atra, immersa, erumpentia, separata vel confluentia, glabra, 250-550(-750) μm diam ubi separata, usque ad 550 μm elata, unilocularia; paries crassus, cupulatus, pars supera affixa in epidermide hospitis. Stratum supremum conidiomatis ex columnis erectis cellularum elongatarum compositum. Ostiolum cellulis atriparietibus cinctum, ca 40 μm diam. Ontogenesis conidiorum holoblastica. Conidiophoris carentia. Macroconidia solitaria, cylindrata, extremis ambobus obtuse rotundatis, hyalina, levia, (2-)3(-5) septata, interdum septis aliquantum constricta, 55-84 x 7-11.5, $\bar{x}$=66.2 x 8.8 μm. Microconidia ex cellulis in pariete supero et canale ostioli loculi formata, cylindrata, ovata, truncata termino uno, irregulariter formata, saepe curva, aseptata, levia, hyalina, 5.5-11.5 x 2.5-4 μm.

Conidiomata (Fig. 2, A) amphigenous, subepidermal, black, immersed, erumpent but a rim remaining covered by the epidermis, separate or confluent, glabrous, 250-550(-750) μm diam when separate, up to 550 μm tall, unilocular; wall thick, cup-shaped, upper surface attached to the host epidermis, the base 40-60 μm thick, composed of 8-12 layers of gray-black, thick-walled cells, lighter toward the interior, and inner wall of 2-4 layers of hyaline cells, outer side walls generally thicker. The top layer of a conidioma composed of vertical columns of elongated cells. Ostiole surrounded by black-walled cells, ca 40 μm diam, exposed by rupture and/or breaking away of the host epidermis at the inner edge of the wall. Conidial ontogeny

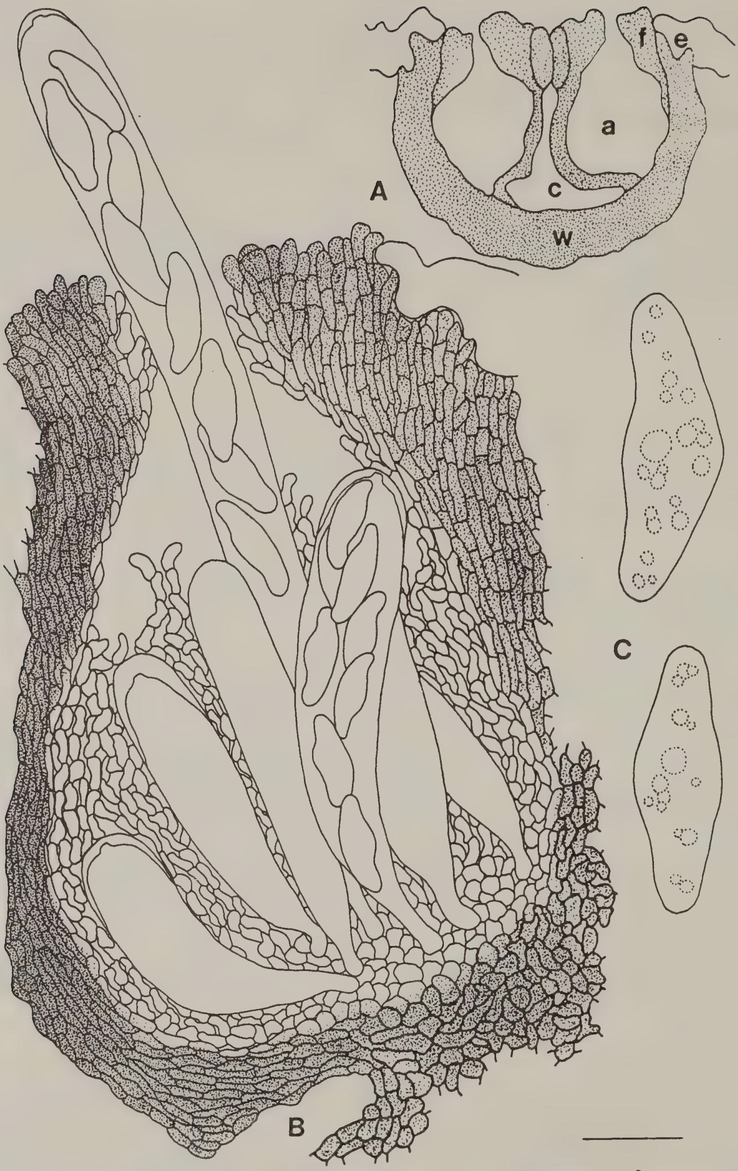


Fig. 1. A-C, *Planistroma obtusilunatum*. A. Diagram of stroma with ascogenous locules; w=wall, f=filamentous part of stroma, a=ascogenous locule, c=collapsed conidial locule, e=host epidermis. B. Detail of ascogenous locule pictured in A. C. Ascospores, the lower drawn from a view at 90 degrees from the upper. Standard line = A, 150 μm; B, 33 μm; C, 15 μm.

holoblastic. Conidiophores absent. Macroconidiogenous cells (Fig. 2, B) lining lateral and basal walls of a locule, short-cylindric, hyaline, smooth, 10-20 x 4-5.5 μm, each forming a single conidium. Macroconidia (Fig. 2, C) single, cylindric, both ends bluntly rounded, hyaline, smooth, (2-)3(-5) septate, sometimes slightly constricted at the septa, 55-84 x 7-11.5, $\bar{x}$=66.2 x 8.8 μm. Microconidia formed by cells (Fig. 2, D) that line the upper wall and ostiolar channel of a locule, smaller than the macroconidiogenous cells, rarely proliferating percurrently (Fig. 2, D). Microconidia (Fig. 2, D) cylindric, ovate, truncate at one end, irregularly shaped, often bent, aseptate, smooth, hyaline, 5.5-11.5 x 2.5-4 μm. Spermatia formed on a part of the lateral or basal walls of a macroconidiogenous locule, in one or more separate locules in a conidium-forming stroma, or in a separate, usually multilocular stroma (Fig. 2, E). Spermatiogenous locules separated by vertical columns of cells, each with an ostiole, or becoming confluent and emptying from a single ostiole. Spermatiogenous cells (Fig. 2, F) lining the basal and lateral locular walls, cylindric to elongate-conical, ca 12-20 x 1.5-3.5 μm, discrete or integrated on a 1-4-septate, sometimes sparingly-branched spermatiophore, determinate, hyaline, smooth, thin-walled, phialidic, forming acrogenous spermatia. Spermatia bacillary, (Fig. 2, F) hyaline, aseptate, smooth, thin-walled, 3-6.5 x 1.5 μm. Conidiogenous cells lining the upper walls of spermatiogenous locules form microconidia as in macroconidiogenous locules.

Substrate: Leaves of *Yucca* spp.

HOLOTYPE: USA. COLORADO: La Plata County, Durango, Smelter Mountain, *ex foliis emortuis Yucca baccata* Torrey, 10 February 1992, Annette Ramaley No. 9018, UC 1475095. ISOTYPES: BPI 1110167, COLO F-18028. Paratypes: (1) USA. NEVADA: Clark County, near Gold Butte, on *Yucca brevifolia* Engelmann, 29 July 1955, Isabelle Tavares No. 28, UC M143776; (2) USA. COLORADO: Huerfano County, Mile 65.2 along Interstate 25, west side of road, on *Yucca glauca* Nuttall, 31 March 1992, Annette Ramaley No. 9204, UC 1475097; (3) USA. COLORADO: La Plata County, Durango, Fort Lewis College Campus, on *Yucca harrimaniae* Trelease, 8 March 1991, Annette Ramaley No. 9013, UC 1475098; (4) USA. NEVADA: Clark County, near Gold Butte, on *Yucca schidigera* Roezl ex K. E. Ortgies, 29 July 1955, Isabelle Tavares No. 33b, UC M143760.

Discussion

Piptarthron uniloculare conidiomata are unilocular whereas conidiomata of all other *Piptarthron* species are potentially multilocular. *P. macrosporum* (Durieu & Montagne) Höhnel has one to six locules. *P. yuccae* (Ellis & Everhart) Sutton has one to four, and *P. pluriloculare* four to more than thirty locules. *P. uniloculare* conidia are shorter than those of any other *Piptarthron* species, and both ends are bluntly rounded. In *P. macrosporum*, the only other species with regularly septate conidia, the conidial apex is somewhat pointed.

Conidia germinated readily and formed colonies with white aerial, appressed, and subsurface mycelium with a yellow reverse. Conidiomata contained typical *Piptarthron uniloculare* conidia as had conidiomata derived from cultured asci. The teleomorphic and anamorphic forms were therefore considered to belong to the same holomorph.

Stagonospora gigantea, Heald and Wolf, Mycologia 3: 522. 1911.-----Fig. 2, G-J.

Pycnidia (Fig. 2, G) immersed, erumpent, the host epidermis cracking across the top and sometimes chipping away centrally, amphigenous, brown, subepidermal, 400-625 μm diam, thick-walled; the wall of many layers of brown, thick-walled *textura angularis*, lighter toward the interior. In young conidiomata, the structure a solid mass of non-columnar cells with the interior portion hyaline and outer layers brown. Mature conidiomata with ca 4 layers of nearly hyaline cells including the conidiogenous layer inside the brown wall layers. Maturing conidiomata developing columns of elongate, thick-walled lighter brown cells in contact with the host epidermis with few cells immediately adjacent to the ostiolar channel becoming very dark brown. Periphysis-like cells in and near the ostiolar channel, but no free microconidia observed. Ostiole ca 30 μm diam. Conidial ontogeny holoblastic. Conidiogenous cells (Fig. 2, H) lining the entire inner surface of a conidioma, short-cylindric, hyaline, smooth, each forming a single, acrogenous conidium. Conidia (Fig. 2, J) smooth, hyaline, cylindric or more often slightly clavate, the base bluntly rounded or truncate, often with a distinct marginal frill, the apex somewhat more acute, (3-)4-5(-7) septate, 72-118 x 9.5-15 μm.

HOLOTYPE: USA. TEXAS: Austin, on *Agave americana* Linnaeus, 22 May 1909, D. Heald and F. A. Wolf, Type specimen #1283, USDA-BPI- ex: 66706, from UC 971418. Other material examined: (1) USA. CALIFORNIA: Riverside County, Palms to Pines Highway, on *Agave deserti* Engelmann, February 1940, H. E. and S. T. Parks, UC M30043; (2) USA. CALIFORNIA: San Diego County, Mason Valley, on *Agave deserti* Engelmann, 1 January 1936, H. G. MacMillan and W. B. Welch, UC 145800.

Discussion

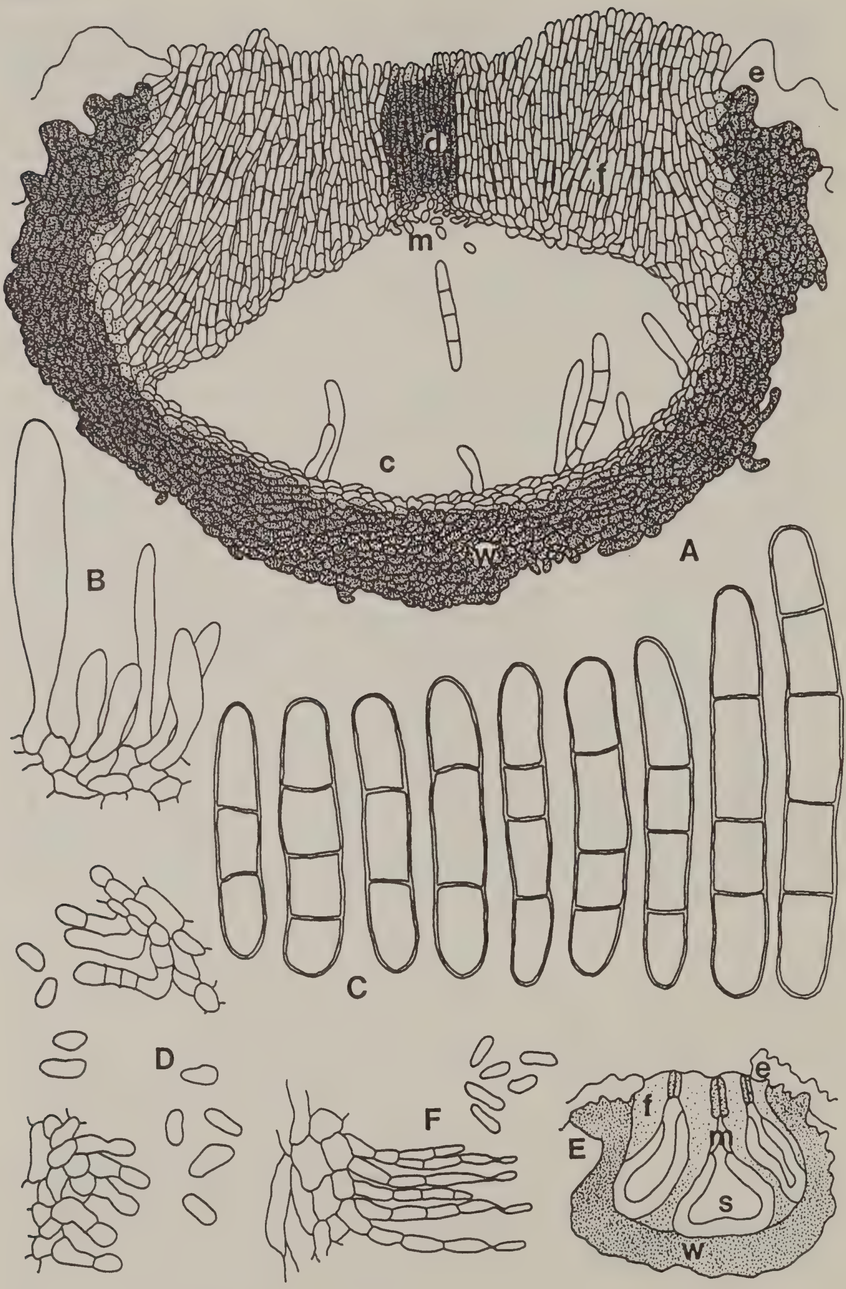
The two specimens of *S. gigantea* from *Agave deserti* Engelmann were not significantly different from the type.

Development

In *Piptarthron uniloculare*, very young conidiomata consist of a shallow cup of *textura angularis*-like cells from which arise columns of cells whose upper surface is in contact with the host epidermis. Pigmentation of the cup begins as greyish, blackening spots on the walls. The conidiomatal chamber originates in the lower part of the columnar portion of the stroma, near the upper surface of the cup-shaped wall. Conidia are formed on the basal and lateral walls of the chamber but are generally absent from the upper wall in mature conidial stromata. As stromata mature, microconidium formation occurs in the vicinity of the ostiole and in the developing ostiolar channel. The microconidiogenous cells appear much like periphyses in perithecial ascostromata, but cut off microconidia as an added feature. The function of the microconidia is not known. Stromata that eventually form spermatial or ascogenous locules retain a considerable lateral filamentous portion (Fig. 2, A). In stromata not developed beyond conidiogenesis, the filamentous structure is obvious only at the top of the conidial locule, especially in the area around the ostiole.

Planistroma obtusilunatum locules develop in a pre-formed stroma in which conidia and/or possibly spermatia have been produced (Fig. 1, A). At particular times of the year, or under certain climatic conditions, bacillary cells believed to be spermatia because of their size, shape, and destiny are formed in the same locule with conidia, in separate locules, or in locules in separate conidiomata. At about the same time, groups of flexuous hyphae extending above the stromata originate at scattered sites in the columnar portion of the conidial or spermatial stromata. The bacillary cells adhere to these hyphae which are continuous through the columnar stromatic cells down to several series of enlarged cells at the base of the developing ascogenous locule. The columnar cells in the area are 'redesigned' into the copious pseudoparenchyma of the ascogenous locules. The asci mature as the conidia are shed and the expanding ascogenous locules collapse the walls of the single, central, conidial or spermatial locule. Occasional retention of a few typical conidia in the collapsed central locule makes it possible to connect the ascus-bearing and conidium-bearing stromata with certainty. The only conidia so associated with *Planistroma obtusilunatum* were typical *Piptarthron uniloculare* conidia. The anamorph is far more common than the teleomorph as is true for *Planistroma yuccigena.*

Ascus development takes place among the cells of the centrum pseudoparenchyma. The sterile cells gradually disappear beginning from the upper portion of the locule and proceeding downward. However, even as early-formed asci become mature, a large part of these interthecial tissues remain in place. The contents of an ascogenous locule are not surrounded by a wall derived from spermatization (Fig. 1, B). Layers of hyaline to brown, thin- to thick-walled cells can be seen at the periphery of the locule, but these are, or are derived from, the columnar stromatic cells just as is the pseudoparenchyma of the locule. In favorable sections the 'wall' cells are seen to be continuous with columns of cells that reach the upper stromatic surface separated from the locule.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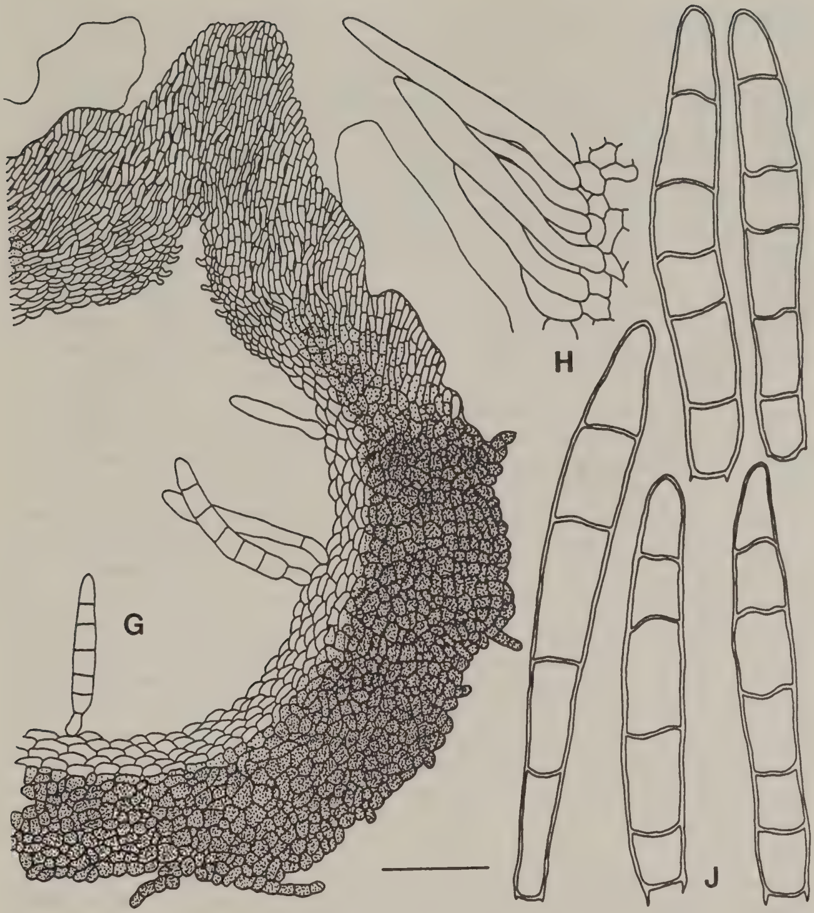

Fig. 2. A-F, *Piptarthron uniloculare*; G-J, *Stagonospora gigantea*. A. Conidioma; c=macroconidiogenous region, d=dark-walled cells surrounding ostiolar channel, e=host epidermis, f=filamentous part of stroma, m=microconidiogenous region, w=wall. B. Conidiogenous cells producing macroconidia. C. Macroconidia. D. Conidiogenous cells and microconidia. One pictured microconidiogenous cell has annellations, but this is rare. E. Small spermatiogenous stroma; e= host epidermis, f=filamentous part of stroma, m=microconidiogenous region, s=spermatiogenous region, w=wall. F. Detail of spermatiogenesis and spermatia. G. Conidioma. H. Conidiogenous cells and developing conidia. J. Conidia. Standard line = A, G, 75 μm; B, C, D, H, J, 20 μm; E, 150 μm; F, 15 μm.

Discussion

The relationships of *Planistroma obtusilunatum* beyond other *Planistroma* species on *Yuccà* are not obvious. *Planistroma* was distinguished from other genera with multilocular stromata (7) with which it was compared. The shape of *P. obtusilunatum* ascospores is like that of certain *Discochora* (=*Guignardia*) species (2) also occuring on monocots, and *Leptoguignardia* (6). However, *P. obtusilunatum* ascospores are considerably larger, and *Discochora* and *Leptoruignardia* have unilocular stromata. According to Eriksson's definitions, the *Planistroma* hamathecium has either, (a) 'interascal pseudoparenchyma' that is unchanged or compressed between developing asci, or (b) 'paraphysoids,' interascal tissue that comes to resemble pseudoparaphyses. The origin of these two hamathecium types is the same--they are separated by their final appearance. *P. obtusilunatum* interascal tissue already resembles some pseudoparaphyses by its columnar structure of more or less elongated cells. Although laterally compressed by maturing asci, these cells remain essentially unaltered in length as the asci mature. There is no stretching or narrowing with an increase in height of the ascoma. The sterile elements of the centrum of *Discochora* and *Leptoguignardia* are called 'pseudoparaphysoids' (8), or 'pseudoparaphyses' (1), or, for *D. yuccae*, 'paraphysoids' (2). Whatever name used for the hamathecium of *Discochora* and *Leptoguignardia*, the cells involved are narrowed, and absent, or mostly so, by maturity. The origin might be similar, but the final appearance of the hamathecium of *Planistroma* and *Leptoguignardia* or *Discochora* is quite different. Most of the morphological evidence--unilocular vs. multilocular stromata, ascospore size, hamathecium appearance, the anamorph preceding the teleomorph in the same stroma--does not favor a close tie between *Planistroma* and these genera. In addition, the *Phyllosticta* anamorphs known for several *Discochora* species are quite unlike *Piptarthron.*

Piptarthron uniloculare is clearly related to the other described *Piptarthron* species (7) and *Kellermania* (6). The similarity of *Piptarthron macrosporum* and *Kellermania* was noted by Höhnel when the generic name *Piptarthron* was validated (5). A stroma composed of a dark cup of thick-walled cells surmounted by more or fewer columns of elongate cells is common to both genera. Conidiogenesis is holoblastic, and the conidia are large, hyaline, and born singly on the conidiogenous cells in these fungi.

The characters used to separate taxa in the *Piptarthron/Kellermania* complex include presence or absence of an apical conidial appendage, and septation of the conidia. The number of locules in the conidiomata could also be used. Both *Kellermania* species have a single locule, and the three *Piptarthron* species described prior to *P. uniloculare*, all may be more or less multilocular. The relationships of *P. uniloculare* are with *Piptarthron*, when presence or absence of an apical conidial appendage is used as the primary character for separation, and with *Kellermania*, when the number of locules in a conidioma is used. *P. uniloculare* conidia lack the apical appendage of *Kellermania*, but are more like *Kellermania* than *Piptarthron* in size and shape.

Piptarthron uniloculare was initially considered to be a new genus with morphological characteristics between *Kellermania* and *Piptarthron*. The teleomorph was described as a species of *Planistroma* with somewhat anomalous ascospores. Recent collections of these and related fungi revealed that the teleomorphs of *Kellermania yuccaegena* Ellis & Everhart and a new, closely related taxon (unpublished), have septate ascospores. Although the ascospores of the teleomorph of *P. uniloculare* differ in shape from those of the teleomorphs of other *Piptarthron* species, they are, with very rare exceptions, aseptate. With some reservations, the fungus described here as *P. uniloculare* was, therefore, placed in *Piptarthron*. This placement provided a single anamorph genus for the teleomorph, *Planistroma,* perhaps a more agreeable arrangement with the knowledge now available.

Comparison of the descriptions of *Piptarthron uniloculare* and *Stagonospora gigantea* shows the major differences to be: (a) size and shape of the conidia; (b) young conidiomata of *P. uniloculare* consist of a shallow cup of *textura angularis*-like cells with columns of elongate cells extending upward toward the host epidermis, whereas young conidiomata of *Stagonospora gigantea* consist of a solid mass of cells not arranged in vertically oriented columns, columns of elongate cells belatedly appearing in conjuction with ostiole formation; (c) pigmentation in *P. uniloculare* is gray-black or greenish-black in the columnar portion of mature condiomata that is yellowish when young, whereas *Stagonospora gigantea* conidiomata are brown; (d) *P. uniloculare* forms microconidia in the vicinity of the ostiole and in the ostiolar channel, whereas *Stagonospora gigantea* has periphysis-like cells present in the ostiolar channel but does not produce microconidia. In addition, *P. uniloculare* has been found only on dead leaves of *Yucca* spp., whereas *Stagonospora gigantea* was described as a serious disease of *Agave americana*. The different host genus might be thought to account for the parasitic vs. saprophytic host relationship. If that were the only difference between the two fungi, it might not justify their separation. However, as listed above, other differences exist that do not appear to be host-related.

Although *Piptarthron uniloculare* is separated from *Stagonospora gigantea* by several characters, the two taxa may not be unrelated. Both species have large, thick-walled conidiomata and large, hyaline, septate, unappendaged, similarly-born conidia that look more alike than do those of *S. gigantea* and some other *Stagonospora* species. Sivanesan (8) summarizes the life cycles for ten taxa with *Stagonospora* anamorphs. The teleomorphs belong to *Leptosphaeria* (seven species), *Pleospora* (two species), and *Didymella* (one species). In all cases, the teleomorph has unilocular pseudothecia, septate ascospores, and pseudoparaphyses that originate above the asci, and grow downward to the base of the locule. Only *Didymella* has hyaline 1-septate ascospores, the others are yellow to brown, at least in age, and several-septate

(*Leptosphaeria*) or dictyosporous (*Pleospora*). When the life cycle for *Stagonospora gigantea* is completely known, it will be interesting to see whether it resembles *Piptarthron*, with a *Planistroma*-like teleomorph, whether it has a teleomorph more like other *Stagonospora* species, or whether it is different from either alternative. The presence of a pycnidial coelomycete with spermatium-like conidia and an accompanying *Pleospora* species in aging *Stagonospora gigantea* lesions (UC M30043) is tantalizing! However, saprophytes on *Yucca* leaves often share sites with hemibiotrophes, and *Agave* is probably similar. Fresh collections must be made, and reproductive structures formed in cultures from any presumed teleomorph compared to those formed in cultures of the anamorph.

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My thanks to the curator of the Herbarium, University of California, for allowing me to examine specimens housed at that institution, and Dr. Edouard Thai for correcting the Latin descriptions. The counsel, suggestions, and helpful review of the manuscript provided by Dr. Mary Palm are very much appreciated.

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SIX SPECIES OF *SCLERODERMA* (GASTEROMYCETES, SCLERODERMATALES) DESCRIBED FROM PURE CULTURES

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ABSTRACT

Seventeen isolates representing six species of the gasteromycete genus *Scleroderma* Persoon were cultured from juvenile basidioma tissue. Culture mats, hyphae and growth rates were characterized and compared among isolates and species. Isolates within a taxon were generally consistent morphologically, but they often differed in growth rate. A dichotomous key is provided to distinguish species based on the cultural characters described.

INTRODUCTION

The genus *Scleroderma* Persoon (Gasteromycetes, Sclerodermatales) comprises 21 species worldwide (Guzmán 1970). Basidiomata are characterized by a rigid peridium, a nearly black gleba upon maturity, and with basidiospores coarsely reticulate to acutely spined. Many of the species have a wide geographic distribution, but a few are limited in their range (Smith 1951, Šebek 1955, Guzmán 1970, Calonge and Demoulin 1975, Demoulin 1975, Garrido 1984).

Scleroderma spp. are important ectomycorrhizal fungi of both coniferous and deciduous trees, many species being studied for their potential to enhance tree growth (*e.g.*, Marx and Bryan 1969, Kropp and Trappe 1982, Molina and Trappe 1982, Beckjord and McIntosh 1984, Danielson 1984, Jones *et al.* 1986, Richter and Bruhn 1986, 1989, 1990). Enzyme tests suggest the genus may be wholly mycorrhizal (Richter and Bruhn 1989), rather than partly saprotrophic as once proposed (Šebek 1955, Guzmán 1970).

A world monograph of the genus *Scleroderma* based solely on basidioma characters was published by Guzmán (1970). Less is known about the cultural characteristics of species of *Scleroderma*, although isolates can easily be obtained from fresh basidioma tissue. The best known species is *S. citrinum* Pers. (=*S. aurantium* [Vaill.] Pers.), described in pure culture by Miller *et al.* (1983) and Hutchison (1991). The latter author described the cultural characteristics of two additional species, *S. arenicola* Zeller and *S. bovista* Fr.

To identify mycorrhizal fungi isolated from root tips or soil, it is important to have accurate published descriptions of known mycorrhizal fungus cultures (Miller *et al.* 1983, Hutchison 1991). Culture growth rate data can further be used to characterize and distinguish species. The purpose of this paper is to report macro- and micromorphological characters and growth rates of six common species of *Scleroderma* from pure cultures.

MATERIALS AND METHODS

Collections of *Scleroderma* spp. basidiomata were made in forested areas of the Great Lakes States, U.S.A. Pure cultures of fungi were obtained from fresh juvenile sporocarps by plating on Modified Melin-Norkrans (MMN) agar (Marx 1969) in petri dishes. Sporocarps were surface sterilized with 10% chlorine bleach, rinsed with sterile water, and using a fine-pointed sterile forceps, inner pieces of tissue approximately 2-5 mm^3 were removed. These were placed firmly on or slightly into the agar surface. Within 1-2 wk at room temperature (18-22°C) uniform mycelial mats grew from pieces of cultured tissue. Cultures were maintained by transferring at 6 mo intervals to MMN agar slants in test tubes, incubated for 30-60 da at room temperature, and refrigerated at 5°C. Voucher specimens are deposited in the herbarium of the Field Museum of Natural History, Chicago, Illinois, or maintained in the author's collection. A list of isolates examined and location of collections is given in Table 1.

Cultures examined were grown on MMN agar in 100 mm petri dishes for 30 da at 20°C in the dark. Inoculum 2-3 mm^3 obtained from the margin of an active culture was used to inoculate the center of a petri dish. Dishes were sealed with plastic film and placed upright. Growth rate was expressed as the mean diameter of 5-17 replicate mats measured at the widest portion. Growth data among species and among isolates within species were analyzed by ANOVA and significantly different means identified by Tukey's test ($p<0.05$).

Mat height is defined as mycelial growth above the agar surface. Descriptions of colors are after Kornerup and Wanscher (1978). Active mycelium from the margin of a mat was mounted in 5% KOH and viewed with a Nikon Optiphot^R microscope using Nomarsky optics at 400X. Measurements of 10-15 hyphae were made to the nearest µm. Mean diameter is given along with the minimum and maximum in parentheses. Size of clamps, usually more uniform than hyphae, reflects 5-10 measurements at their broadest dimension parallel to their supporting hypha.

Table 1. Collection data for *Scleroderma* spp. tissue isolates used for cultural studies.

Scleroderma Species	Isolate Number	Vou. Loc.*	Date Col. (mo/yr)	Location Collected (County, State)	Habitat	Associated Trees@
bovista	DR-109	MTU	8/85	Houghton, Mich.	mine spoil sands	B, Po
bovista	DR-130	MTU	9/85	Sauk, Wis.	dry plantation	Pir
bovista	DR-179	FMNH	9/86	Houghton, Mich.	gravel bank	Pir
citrinum	DR-10#	MTU	9/83	Schoolcraft, Mich.	dry plantation	Pir
citrinum	DR-151	MTU	10/85	Houghton, Mich.	mesic plantation	Pir
citrinum	DR-161	MTU	8/86	Burnett, Wis.	dry forest	B, Pib, Qr
citrinum	DR-177	FMNH	8/86	Houghton, Mich.	mesic plantation	Pir
citrinum	DR-180	FMNH	9/86	St. Louis, Minn.	sandy beach	Pc
meridionale	DR-131	MTU	9/85	Richland, Wis.	sand dunes	B, Pir, Po, Qr
meridionale	DR-142	MTU	10/85	Houghton, Mich.	sandy beach	B, Po
meridionale	DR-150	MTU	10/85	Baraga, Mich.	sandy beach	B, Pc, Po, Qr, Pib, Pir, Pis
polyrhizum	DR-154	MTU	9/85	Richland, Wis.	sand dunes	B, Pir, Po, Qr
areolatum	DR-120	MTU	9/85	Houghton, Mich.	mesic forest	Pir, Qr
areolatum	DR-166	MTU	8/86	Sherburne, Minn.	mesic forest	Qm, Qr
areolatum	DR-167	MTU	8/86	Burnett, Wis.	dry forest	B, Pib, Qr
cepa	DR-132	MTU	9/85	Sauk, Wis.	dry forest	Pir
cepa	DR-164	FMNH	8/86	Houghton, Mich.	dry forest	B, Qr

* Voucher Location: MTU=Author's collection, Michigan Technological University; FMNH= Field Museum of Natural History, Chicago, Illinois.

@ B=*Betula*, Pc=*Picea*, Pib=*Pinus banksiana*, Pir=*Pinus resinosa*, Pis=*Pinus strobus*, Po=*Populus*, Qm=*Quercus macrocarpa*, Qr=*Quercus rubra*.

S. citrinum DR-10 deposited in the American Type Culture Collection, No. 60969.

RESULTS

Scleroderma bovista Fries

Macromorphology: Mat height 1-4 mm, surface pale yellowish white (2A2) to pastel yellow (2A4) with light brown center (5D8), underside brownish yellow (5C8) with alternating light and dark concentric growth rings; texture felty to woolly, denser in center; mat margin flaring or even; agar tinted yellow (2A7) immediately surrounding mat.
Micromorphology: Hyphae (2-)3.5-4.1(-6) µm wide, contents clear or slightly granular, colorless to light yellow (2A5); clamps abundant, 4-8 µm across, intercalary and at simple and multiple branch junctions (Fig. 1A), very few branch junctions unclamped; occasional intertwined hyphae (Fig 1B) (in one isolate mycelial strands beginning to develop, few to many hyphae bundled together with nodes along their length where groups of clamps occur); infrequent staghorn branches composed of short, aseptate hyphae (Fig. 1C); abundant dendritic-flaring, deep yellow (4A8) crystals in agar surrounding oldest hyphae, 10-30 µm broad (Fig 1D).
Growth rate: (12-)21.4(-32) mm. (Growth rates for all *Scleroderma* isolates and species are given in Table 2.)

Scleroderma citrinum Persoon

Macromorphology: Mat height 1-3 mm, surface pale yellow (2A3) to light yellow (2A5) with brownish yellow (5C8) center, underside apricot yellow to brownish yellow near center; texture felty to very loosely woolly; mat margin flaring and much less dense; agar tinted light yellow (2A5) throughout.
Micromorphology: Hyphae (2-)3.2-4.4(-7) µm wide, contents clear or slightly granular, colorless to light yellow (2A5); clamps abundant, 4-6 µm across, intercalary and at simple and multiple branch junctions, very few branch junctions unclamped; occasional intertwined hyphae (in one isolate mycelial strands beginning to develop, 8-15 hyphae bundled together with nodes along their length where groups of clamps occur); infrequent staghorn branches composed of short, aseptate hyphae; abundant dendritic-flaring, deep yellow (4A8) crystals in agar surrounding oldest hyphae, 10-30 µm broad.
Growth rate: (18-)26.8(-48) mm.

Scleroderma meridionale Demoulin & Malençon

Macromorphology: Mat height 2-5 mm, surface milk white (1A2) to pastel yellow (2A4), underside brownish yellow (5C8) to dark brown (5F7) near center with alternating light and dark concentric growth rings; texture densely woolly; mat margin flaring and much less dense; agar untinted to light yellow (2A5) immediately surrounding mat.
Micromorphology: Hyphae (1-)2.5-3.6(-5) µm wide, contents clear or slightly granular, colorless to light yellow (2A5); clamps abundant, 4-7 µm across, intercalary and at simple and multiple branch junctions, many branch junctions unclamped; occasional intertwined hyphae and

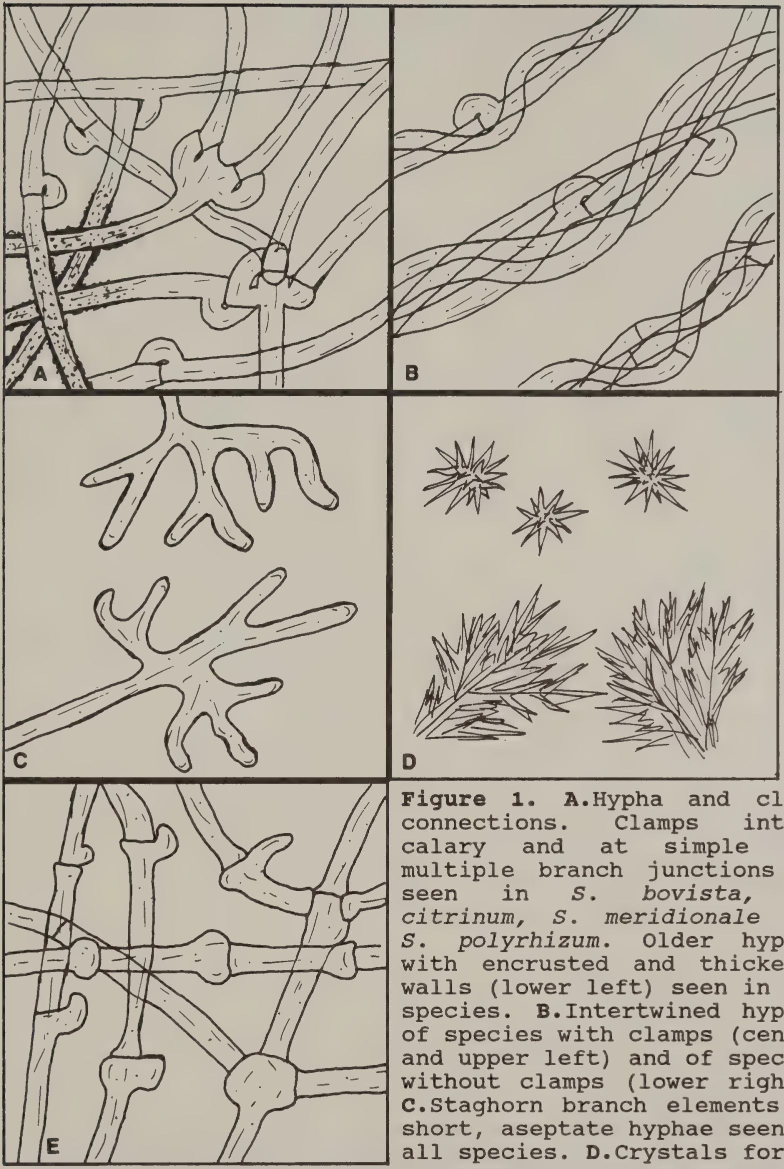

Figure 1. **A.**Hypha and clamp connections. Clamps intercalary and at simple and multiple branch junctions as seen in *S. bovista, S. citrinum, S. meridionale* and *S. polyrhizum*. Older hyphae with encrusted and thickened walls (lower left) seen in all species. **B.**Intertwined hyphae of species with clamps (center and upper left) and of species without clamps (lower right). **C.**Staghorn branch elements of short, aseptate hyphae seen in all species. **D.**Crystals formed in agar around older hyphae. Rounded, stellate, colorless crystals (upper) seen in *S. polyrhizum* and dendritic-flaring, deep-yellow crystals (lower) seen in all other species. **E.**Hyphae of *S. areolatum*. Septae at simple and multiple branch junctions. Diverse and erratic branching with swellings at septae resembling false-clamps. (All approx. X850.)

Table 2. Growth of *Scleroderma* spp. isolates on MMN agar (30 da, 20°C), and pooled means for each species.

Scleroderma Species	Isolate Number	Age (mo)[*]	n	Colony Diameter (mm)			
				Mean[@]	Min.	Max.	SD
bovista	DR-109	20	10	21.2_a	20.0	23.0	1.1
bovista	DR-130	19	9	28.9_b	25.0	32.0	2.3
bovista	DR-179	7	9	14.0_c	12.0	16.0	1.5
bovista	**ALL ISOLATES:**		**28**	**21.4_A**	**12.0**	**32.0**	**6.3**
citrinum	DR-10	43	10	39.9_a	30.0	48.0	6.5
citrinum	DR-151	18	15	21.3_b	18.0	25.0	1.7
citrinum	DR-161	8	10	25.2_c	21.0	28.0	1.9
citrinum	DR-177	8	8	19.8_b	18.0	24.0	1.9
citrinum	DR-180	7	10	27.7_c	24.0	32.0	2.7
citrinum	**ALL ISOLATES:**		**53**	**26.8_B**	**18.0**	**48.0**	**8.5**
meridionale	DR-131	19	17	19.5_a	15.0	22.0	1.7
meridionale	DR-142	18	12	19.8_a	15.0	27.0	3.5
meridionale	DR-150	18	5	17.2_a	15.0	19.0	1.5
meridionale	**ALL ISOLATES:**		**34**	**18.8_A**	**15.0**	**27.0**	**4.1**
polyrhizum	DR-154	19	**15**	**25.3_{AB}**	**20.0**	**34.0**	**4.3**
areolatum	DR-120	19	7	29.3_a	26.0	36.0	3.7
areolatum	DR-166	8	5	28.6_a	27.0	30.0	1.3
areolatum	DR-167	8	8	35.1_b	28.0	35.0	5.8
areolatum	**ALL ISOLATES:**		**20**	**31.5_B**	**26.0**	**36.0**	**5.1**
cepa	DR-132	19	8	40.5_a	32.0	50.0	6.7
cepa	DR-164	8	10	39.6_a	35.0	43.0	2.4
cepa	**ALL ISOLATES:**		**18**	**40.1_C**	**32.0**	**50.0**	**7.5**

[*] Age of culture in months from isolation to measurement of growth rate.

[@] Lower case letters indicate significant differences between means for isolates within a species. Upper case letters indicate significant differences between means among species (Tukey's test, $p < 0.05$).

groups of parallel hyphae forming strands; infrequent or absent staghorn branches composed of short, aseptate hyphae; abundant dendritic-flaring, deep yellow (4A8) crystals in agar surrounding oldest hyphae, 10-30 µm broad.
Growth rate: (15-)18.8(-27) mm.

Scleroderma polyrhizum **Persoon**
Macromorphology: Mat height 1-2 mm, surface Sahara brown (6C5) to tan (6E6), darkest in center with light rim, underside brownish yellow (5C8); texture felty; mat margin flaring and less dense; agar tinted apricot yellow (5B6) throughout.
Micromorphology: Hyphae (2-)3.6(-6) µm wide, contents predominantly granular, colorless to light yellow (2A5); clamps abundant, 4-6 µm across, intercalary and at simple and multiple branch junctions, all branch junctions clamped; abundant intertwined hyphae; abundant staghorn branches composed of short, aseptate hyphae; rounded, stellate colorless crystals in agar surrounding oldest hyphae, 10-20 µm diameter (Fig. 1D).
Growth rate: (20-)25.3(-34) mm.

Scleroderma areolatum **Ehrenberg**
Macromorphology: Mat height 3-5 mm, surface yellow (2A7) inwards to dark brown (5F7) margin, underside brownish yellow (5C8) to brown (5E8) near center; texture densely woolly to very loosely woolly towards margin; mat margin flaring; agar tinted vivid yellow (2A8) throughout.
Micromorphology: Hyphae (2-)4.2-4.6(-7) µm wide, contents clear or slightly granular, colorless to light yellow (2A5); clamps absent, most septae at simple and multiple branch junctions, much diverse and erratic branching and many swellings at septae, some resembling false-clamps (Fig. 1E); occasional intertwined hyphae with some larger bundles of hyphae beginning to develop mycelial strands; abundant staghorn branches composed of short, aseptate hyphae; abundant dendritic-flaring, deep yellow (4A8) crystals in agar surrounding oldest hyphae, 10-30 µm broad.
Growth rate: (26-)31.5(-36) mm.

Scleroderma cepa **Persoon**
Macromorphology: Mat height 1-2 mm, surface light yellow (2A5) to apricot yellow (5B6), underside brown (5E8) to dark brown (5F7); texture dense and felty; mat margin flaring; agar tinted yellow (2A7) immediately surrounding mat.
Micromorphology: Hyphae (1-)3.0-4.6(-6) µm wide, contents clear or slightly granular, predominantly light yellow (2A5); clamps absent, septae intercalary and at simple and multiple branch junctions; occasional intertwined hyphae; abundant staghorn branches composed of short, aseptate hyphae; abundant dendritic-flaring, deep yellow (4A8) crystals in agar surrounding oldest hyphae, 10-30 µm broad. (One isolate (DR-164) would frequently sector, and from a normally compact mat, a loosely tomentose mat would

emerge, with distinctly larger hyphae composed of many globose and irregular elements up to 20 µm diameter.)
Growth rate: (32-)40.1(-50) mm.

DISCUSSION

Comparison of Macromorphological Characters

Mat color, height and texture tends to be similar for most *Scleroderma* spp. *Scleroderma polyrhizum* is notably darker than the rest and with tan to pinkish tones. Most species have darker interior portions of the mycelial mat but *S. areolatum* which had a darker margin. *Scleroderma areolatum* and *S. meridionale* tend to have thicker mats while those of *S. cepa* and *S. polyrhizum* are thinner. The other two species are intermediate in mat height. Extremes of mat texture are seen also in *S. cepa* and *S. polyrhizum*, which are consistently felty, while those of *S. areolatum* and *S. meridionale* are consistently woolly.

Tinting of the agar varied somewhat among species. *Scleroderma bovista*, *S. cepa* and *S. meridionale* tinted the agar just around the mat, while the other species tinted the agar throughout. *Scleroderma areolatum* tinted the agar the deepest (vivid) yellow, while *S. polyrhizum* tinted the agar with orange (apricot) tones. This feature is likely to be media-dependent, for when isolates are grown on PDA or YMA the agar is often tinted orange to reddish brown by all species. Hutchison (1991) added yeast extract to MMN agar and reports darker tinting of the agar by the three isolates of *Scleroderma* he studied.

Odor can also be an important distinguishing character of fungus cultures. Among those studied it is similar for all species, being "sweet and earthy", as previously described for *S. citrinum* by Miller *et al.* (1983). Strong, fragrant, and with a characteristic mushroom odor, also could be used to describe the odor of *Scleroderma* spp. cultures.

Comparison of Micromorphological Characters

Width of hyphae is similar among species, most ranging from 3.0 to 4.6 µm. On average, *S. areolatum* tends to have slightly wider hyphae, while *S. meridionale* has slighter narrower hyphae. Hutchison (1991) reports *S. bovista* having narrower hyphae (1.3-2.6(-3.2) µm) than found in this study. The size of *S. citrinum* hyphae reported by Miller *et al.* (1983) and Hutchison (1991) is consistent with the size found in this study.

For those species possessing clamp connections (*S. bovista*, *S. citrinum*, *S. meridionale* and *S. polyrhizum*), their size is generally uniform (4-8 µm wide). Two groups among species can be readily separated microscopically, those with clamps and those without (*S. areolatum* and *S. cepa*). This conforms with section designation of basidiomata by Guzmán (1970). The latter two species, placed in section *Aculeatispora*, lack clamps in basidioma tissue. The former four species, placed in sections *Sclerangium* and *Scleroderma*, possess clamps in basidiomata. In a study by Coccia *et al.* (1990), nine Italian species of *Scleroderma* (which included the six species described here) were similarly divided into two groups on the basis of clamp connections in their basidiomata.

Hutchison (1991) reported that his isolate of *S. bovista* lacked clamps, suggesting that dedikaryotization had taken place. Although this may be a common phenomenon among many basidiomycete tissue culture isolates (Hutchison 1991), among the *Scleroderma* spp. studied here this has not been observed. The presence or lack of clamps has been a constant character for as long as the isolates have been maintained.

Clamps or septae at simple and multiple branch points seems also to be a regular character among species of *Scleroderma,* as well as possessing intertwining hyphae and staghorn branch hyphal elements. Multiple clamp connections as in *S. citrinum* were likewise illustrated by Miller *et al*. (1983) and Hutchison (1991). In isolates of *S. bovista* and *S. citrinum,* groups of hyphae were beginning to form mycelial strands similar to those seen associated with mycorrhizae synthesized with these species (Richter and Bruhn 1986, 1989, 1990).

The formation of crystals in the agar around older hyphae is typical. All species formed dendritic-flaring, deep yellow crystals except *S. polyrhizum,* which formed rounded, colorless crystals. Since only one isolate of that species was examined, it is uncertain how constant this feature is. Also, older hyphae of all species developed encrusted and thickened walls.

Comparison of Growth Rates

Considering species first, three significantly different groups were separated. *Scleroderma bovista* and *S. meridionale* formed the group with slower growth rates. *Scleroderma cepa* had a significantly faster growth rate than the other species. *Scleroderma areolatum* and *S. citrinum* had intermediate growth rates, forming another group. *Scleroderma polyrhizum,* also with an intermediate growth rate, was not significantly different from the slowest group.

Within species, *S. citrinum* had the widest range of growth rates, with three significantly different groups being formed among isolates. Isolate number DR-10, which grew significantly faster than the other isolates, was older than the other isolates by 25 to 35 mo. This isolate may have become conditioned to life on artificial media, although isolates commonly grow slower and eventually die after extended time in culture. Within *S. bovista* isolates three significantly different groups were formed, one which was the slowest growing culture among all species isolates. There was no significant difference in growth rates between two isolates of *S. cepa* or three isolates of *S. meridionale*. Within *S. areolatum,* two groups were again formed, though this species had the narrowest range between isolates.

Literature reports of growth rates of *S. citrinum* (Miller *et al*. 1983, Hutchison 1991) and *S. bovista* (Hutchison 1991) generally agree with those found here, although slightly different media and conditions were employed.

KEY TO SIX SPECIES OF *SCLERODERMA PERS.* IN PURE CULTURE

1. Cultures with clamp connections........................2
1. Cultures lacking clamp connections....................5
    2. Culture mat with tan to pinkish tones.............. ....***S. polyrhizum***
    2. Culture mats with yellowish tones................3
3. Culture mat nearly white, densely woolly.***S. meridionale***
3. Culture mats distinctly yellow, felty and less dense..4
    4. Culture with growth rate typically 14-29 mm diameter in 30 da at 20°C.............***S. bovista***
    4. Culture with growth rate typically 20-40 mm diameter in 30 da at 20°C............***S. citrinum***
5. Culture with growth rate typically <36 mm diameter in 30 da at 20°C....................***S. areolatum***
5. Culture with growth rate typically >36 mm diameter in 30 da at 20°C.........................***S. cepa***

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COMMENTS ON THE EXSICCAT "LECANOROID LICHENS" I

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Abstract: The first fascicle of a new lichen exsiccat "Lecanoroid Lichens" is being issued by the Botanical Institute, University of Essen, Germany. Some remarks on the taxonomy, nomenclature and chemistry of the distributed species are given. *Lecanora haywardiorum* Lumbsch spec. nov. is described from Australia and *L. agustini* Erichsen, *L. ochraceorosea* R.G. Werner and *L. sylvestris* Nyl. are reduced to synonymy with *L. rubicunda* Bagl.

Within the last two decades the generic concepts in lichenology became unstable and a number of new genera and resurrection of older names have been proposed. This new trend was especially true for the families Lecideaceae and Parmeliaceae. While the new taxa involved in the Parmeliaceae in most cases belong to that family, the bulk of new genera segregated from *Lecidea* Ach. s. lat. now belong to more than 50 genera in ca. 22 different families (Hertel & Rambold 1985).

The generic concept within the Lecanoraceae also changed slightly, but less is known about the distribution and the differences of characters within this group. Our knowledge is still based on the pioneer work of Eigler (1969) on the characters within *Lecanora* s. lat. Since then some very aberrant taxa were excluded by Hafellner (1984) and the genus *Aspicilia* already described by Massalongo (1852) is nowadays accepted as a genus of its own belonging to a separate family (Hafellner 1991, Poelt 1974). Further genera have been proposed by several workers (Hafellner & Rogers 1990, Harris et al. 1988, Hertel & Rambold 1987, Kalb 1991, Mayrhofer 1987, Triebel & Rambold 1988). The "Lecanoroid Lichens" should encourage others to pay more attention to this group and will be one part of our contributions to the knowledge of the family-complex.

The "Lecanoroid Lichens" is the first exsiccat distributed by the Botanical Institute at the University of Essen. It is concentrated on the family Lecanoraceae in the wide sense of Zahlbruckner, i.e. including genera which clearly do not belong to the Lecanoraceae s.str. The exsiccat will be issued in 20 sets and distributed to the following herbaria: AK, ASU, B, BM, CANL, CBG, DUKE, ESS, GZU, H, LE, M, NY, PRE, STU, TNS, UPS and the private herbaria of K. Kalb (Neumarkt/Opf.), A. Vezda (Brno) and G. Vobis (Bariloche). Incomplete sets will be preferably send to LD and MEL and the private herbaria of A. Aptroot (Baarn) and V. John (Bad Dürkheim).

The majority of the specimens distributed in the first fascicle were collected in Australia (7), while seven specimens come from Central Europe, three from the Canary Islands and three from Turkey. Material for distribution, also undetermined specimens, in our exsiccat is always greatfully appreciated.

The series "Comments on Lecanoroid Lichens" will accompany the publication of the fascicles. The material is listed here, and for each number an indication of the collection site of the material is given. Furthermore remarks on the chemistry and taxonomy of some species are given as well as the descriptions of new species.

Annotated list of the specimens

No. 1: Haematomma nemetzii Steiner

TURKEY, Anatolia, Prov. Izmir, Yamanlar Dagh, S part, road to Karagöl, 38°32'N, 27°09'E, 700 m alt. On somewhat shaded siliceous rocks with *Anaptychia runcinata, Lecanora sulphurata, Leptogium* spp., 14.IV.1992, H. T. Lumbsch.

This species is restricted in its distribution to the Eastern part of the Mediterranean region (Pisút 1970, 1971). The distinction of *H. nemetzii* and *H. lydicum* Steiner remains dubious. While Pisút (1971) regarded both taxa as conspecific, Huneck & Follmann (1972) found atranorin and psoromic acid in *H. nemetzii*, while *H. lydicum* contained only atranorin. By TLC and HPLC we could detect atranorin as the major substance and an unknown depside as a minor constituent. Chloroatranorin was present in traces.

No. 2: Lecanora bolcana (Pollin.) Poelt

TURKEY, Anatolia, Prov. Izmir, Çesme Peninsula, at the roadside between Karapinar and Balikliova, 38°24'N, 26°37'E, alt. ca. 10 m. On siliceous rocks with *Diploschistes caesioplumbeus, D. euganeus, Lecanora sulphurata, Rimularia insularis* etc., 11.IV.1992, H. T. Lumbsch.

This mediterranean species has been described in detail by Poelt (1958). We agree with Poelt that *L. bolcana* should be kept as an independent species rather than a subspecies of *L. muralis* as Clauzade & Roux (1985) proposed. By HPLC and TLC we could detect usnic acid, zeorin and other unknown triterpenoids.

No. 3: Lecanora caesiorubella ssp. glaucomodes (Nyl.) Imshaug & Brodo
AUSTRALIA, Australian Capital Territory, Molonglo Gorge, 13 km ESE of Canberra, 35°20'S, 149°16'E, 570 m alt. Dry sclerophyll forest on very rocky slopes. On *Callitris* with *Hypogymnia billiardieri*, *Pannoparmelia angustata* and *Parmelia pseudotenuirrima*, 19.VII.1991, H.T. Lumbsch & J.A. Curnow.

This subspecies of *Lecanora caesiorubella* is characterized by the absence of norstictic acid and the presence of atranorin and protocetraric acid (Imshaug & Brodo 1966). By HPLC and TLC we found protocetraric acid and atranorin as major and chloroatranorin as minor compounds.

No. 4: Lecanora gangaleoides Nyl.
Spain, CANARY ISLANDS, La Palma, trail to Montaña de Enrique, 28°38'N, 17°51'W, 900-1100 m alt. On basaltic rocks in pasture land with scattered *Pinus canariensis*, 27.III.1992, G.B. Feige & H. T. Lumbsch.

The relationships of this species were discussed by Lumbsch (1992). The distributed specimen belongs to *L. gangaleoides* s. str. By HPLC and TLC we found gangaleoidin, leoidin and atranorin as major, chloroatranorin as minor substances and skyrin and an unknown depsidone in traces (Fig. 8).

No. 5: Lecanora garovaglii (Koerber) Zahlbr.
ITALY, South Tyrol, Vinschgau, Schlanders, S-exposed slopes at the margin of the town at the roadside. On siliceous rocks with *Aspicilia alphoplaca*, *Acarospora sulphurata*, *Lecanora rupicola* aggr., *Dimelaena oreina*, *Lecanora vallesiaca*, *Lichenothelia* spp., 05.IX.1991, H.T. Lumbsch & S. Paus 05.IX.1991.

Lecanora garovaglii is generally classified in the subgenus *Placodium* (Poelt 1958). However, it seems to be related to *"L." opiniconensis* Brodo and the genus *Rhizoplaca* Zopf, as these taxa all have a cupular excipulum. It might be necessary, pending further studies, to enlarge the concept of *Rhizoplaca* to include placodioid taxa with a cupular excipulum as *Lecanora garovaglii* and *L. opiniconensis*. An analogous situation exists in the case of the distinction of the genera *Bryonora* Poelt and *Protoparmelia* Choisy, where the presence or absence of a cupular excipulum is a major character to distinguish both genera (Poelt & Obermayer 1991). Further studies on the generic concept of *Rhizoplaca* are currently being undertaken by Dr. Bruce Ryan (pers. comm.).

The probable systematic significance of the cupular excipulum has been discussed by Lumbsch et al. (1991). It should be emphasized, however, that the distinction of the families Lecanoraceae and Parmeliaceae and the recognition of natural groups amongst both families is still far from clear. We prefer to retain both families pending further studies on a broad number of species involving as much characters as possible rather than merging both families at this stage of knowledge, because a large number of taxa is involved. It has to be determined whether the cupular, sometimes meristematic, excipulum proprium of the typical Parmeliaceae correlates with other independent characters. This would be necessary, in our opinion, if it is the basis of a sound taxonomy at the family level.

Using HPLC and TLC we found usnic, placodiolic acids and zeorin as major substances and several unidentified triterpenoids (Fig. 9).

No. 6: Lecanora haywardiorum Lumbsch spec. nov.

Typus: AUSTRALIA, New South Wales, Barrington Tops National Park. Rocky crossing waterfalls in wet sclerophyll forest, 32°07'S, 151°29'E, ca. 450 m alt. On siliceous rocks beside stream. Associated lichens include *Porpidia albocaerulescens* and *Xanthoparmelia* spp., 22.VI.1991, H.T. Lumbsch & R.B. Filson (CBG-Holotypus).

Planta saxicola. Thallus crustaceus, uniformis, flavidocinereus vel cinereo-albidus, continuus vel disperse verrucosus ad verruculosus, margine indefinito vel definito, interdum prothallo albo.

Apothecia sessilia, vel saepe ad basin constricta, 0.6-1.8 mm diam.; disci atrofusci ad atrobrunnei; margines laeves ad verruculosi vel verrucosi, elevati. Amphithecium crystalla magna minutaque continens. Parathecium hyalinum, crystalla minuta continens, ca. 10 μm crassum. Epihymenium nec inspersum, neque granulosum, fusco-brunneum. Cortex 25 μm crassum. Hymenium hyalinum, 65-85 μm altum. Hypothecium hyalinum. Paraphyses septatae, ca. 1.5-2 μm crassae. Asci clavati, 50-70 x 10-18 μm. Sporae hyalinae, non-septatae, ellipsoideae, (9)-10.5-13.5-(15.5) x (5.5)-7.5-8.5-(9.5) μm. Pycnidia non visa.

Thallus et apothecia atranorinum. chloroatranorinum, zeorinum et alium continentia.

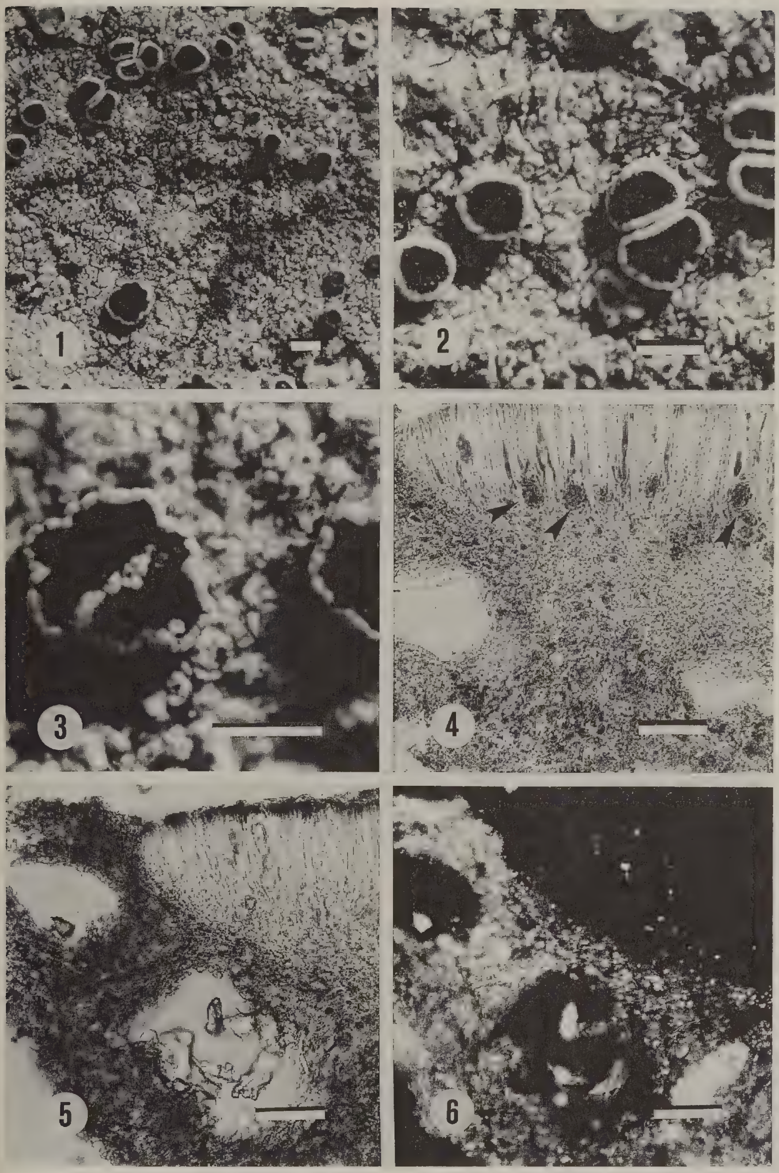
(Figs. 1-6)

Thallus crustose, uniform, whitish to yellowish white or greyish white, continuous or dispersed verrucose to verruculose, epruinose; margin indefinite or definite, sometimes with a whitish prothallus.

Apothecia sessile or often constricted at the base, 0.6-1.8 mm diam.; disks very dark brown to brown-black; margins smooth to verruculose or verrucose, prominent. Amphithecium with large crystals, but also small KOH-soluble crystals abundant. Parathecium hyaline, with small KOH-soluble crystals, bright whitish in polarized light, ca. 10 μm thick. Epihymenium *glabrata* type (Brodo 1984), without crystals, with a 2 μm high hyaline layer above, dark in polarized light, pigmented dark brown to brown. Cortex 25 μm thick. Hymenium hyaline, 65-85 μm high. Hypothecium hyaline. Paraphyses septate, ca. 1.5-2 μm thick, only slightly thickened at the apices. Asci clavate, 50-70 x 10-18 μm. Spores hyaline, non-septate, ellipsoid, (9)-10.5-13.5-(15.5) x (5.5)-7.5-8.5-(9.5) μm. Pycnidia not seen.

Chemistry: Atranorin and zeorin as major compounds, unknown triterpenoids as minor and chloroatranorin sometimes present as minor, sometimes only in traces by HPLC and TLC.

Etymology: The new species is named in honour of Dr. Bruce W. Hayward and Glenys Hayward (Auckland, New Zealand), who contributed much to the knowledge of lichens in New Zealand by their extensive collections and floristic publications. They collected more than a half of the known specimens of the new species.



Figs. 1-6. *Lecanora haywardiorum.* 1-3. Morphology; 4-6. Anatomy. 4. Arrows showing a parasitic fungus growing in the apothecia of the *Lecanora* species; 6. Apothecium in section in polarized light (Scale: 1-3 =1 mm; 4-6=50 μm).

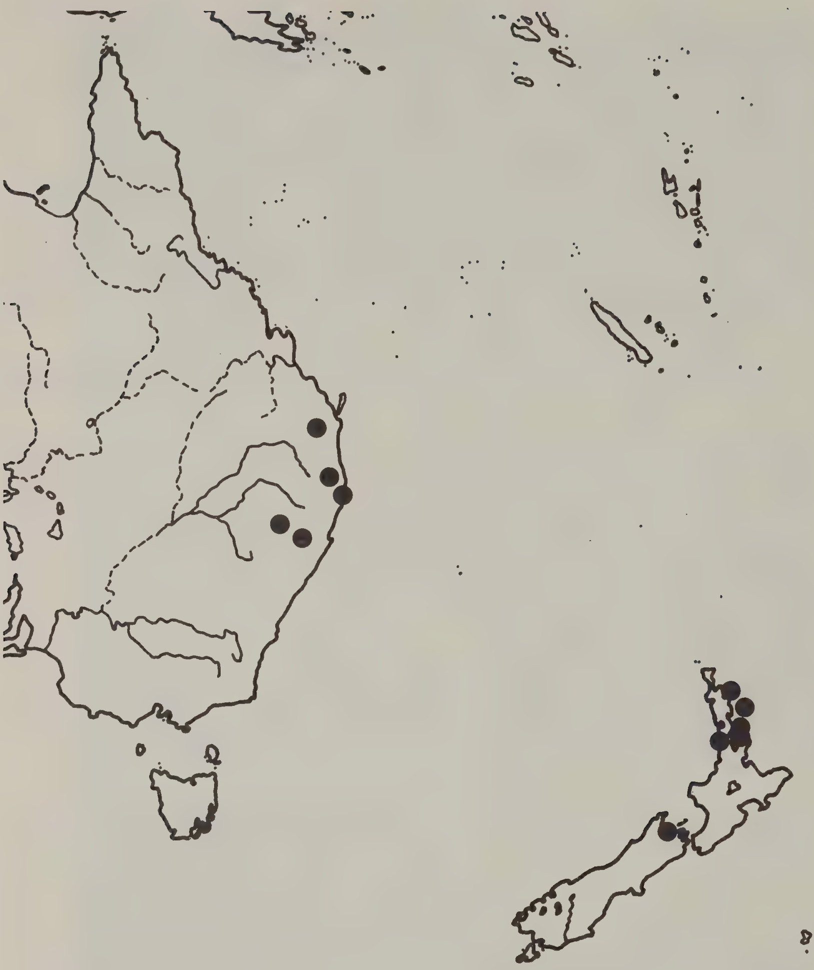


Fig. 7. Distribution map of *Lecanora haywardiorum.*

Habitat: The new species grows on siliceous rocks in exposed to somewhat shaded habitats. Associated lichens found growing with the new species include *Buellia* spp., *Porpidia albocaerulescens, Pertusaria subventosa, Tephromela atra and Xanthoparmelia* spp. In sections of apothecia of the new species a unidentified lichenicolous imperfect fungus was often seen (Fig. 4).

Distribution: *L. haywardiorum* has been collected on the Northern Island of New Zealand at rocky shores and along the coast in New South Wales. Additional collections were made at an altitude of 700-1000 m in New South Wales and Queensland (Fig. 7). The species is not known from outside of Australasia.

Variation: The new species shows only limited variation between the different collections cited below. The coastal populations tend to have a slightly thicker thallus, but this difference is interpreted as a intraspecific variation rather than a difference meriting taxonomic recognition.

Remarks: *Lecanora haywardiorum* is characterized by the dark brown disks, the large and small crystals in the amphithecium, the *glabrata* type epihymenium, the presence of a number of - except zeorin - unidentified triterpenoids in addition to atranorin and the saxicolous habit. Superficially the new species resembles *Tephromela atra* (Hudson) Hafellner and some specimens of *L. haywardiorum* were in fact previously misidentified as this. It differs however, by having a hyaline hymenium, in the ascus type and the secondary metabolites.

Other saxicolous species in the *Lecanora subfusca* group with dark brown to blackish apothecia are *Lecanora argentea* Oxner & Volkova (syn. *L. fuliginosa* Brodo), *L. gangaleoides* Nyl., *L. subgangaliza* Nyl. and some forms of *L. cenisia* Ach. *L. argentea* and *L. gangaleoides* differ from *L. haywardiorum* by the presence of the gangaleoidin chemosyndrome in addition to the atranorin one and both lack zeorin (Lumbsch 1992). *L. gangaleoides* s.str. further contains skyrin. Moreover the thallus in *L. argentea* and *L. gangaleoides* is verrucose to verruculose, almost granular and never continuous (Brodo 1984).

Lecanora subgangaliza can be easily distinguished from *L. haywardiorum* by the *chlarotera* type epihymenium with coarse brownish granules on the surface. It does not contain zeorin and has a brownish hypothecium (Miyawaki 1988). Morphotypes of *L. cenisia* with dark disks differ from the new species by lightly pruinose disks, a *chlarotera* type epihymenium and the absence of zeorin.

Additional specimens examined (=paratypes): **Australia:** New South Wales: 0.5 km S of Kings Beach, Broken Head Nature Reserve, 9 km S of Byron Bay, 28°43'S, 153°36'E, 2 m alt., 2.9.1986, *J.A. Elix 21281* (CBG); McPherson Range, Gradys Creek, E of Cougal, at the edge of Border Ranges Nationalpark, 28°21'30''S, 153°00'30''E, 800 m alt., *J. Hafellner 15532, P. Merrotsy & R.W. Rogers* (hb. Hafellner); Warrumbungle National Park, Burrumbuckee Rock, 21 km WSW of Coonabarabran, 31°20'S, 149°04'E, 720 m alt., 4.10.1977, *D. Verdon 3152* (CBG). - Queensland: Cunninghams Gap National Park, S exposed ridge of Mt. Cordeaux, 28°02'S, 152°23'E, 1000 m alt., 17.9.1986, *J. Hafellner 15322, 15349 & 15360 & R.W. Rogers* (hb. Hafellner). - **New Zealand:** Northern Part: Bay of Islands Co., Urupukapuka Island, 35°12'S, 174°13'E, 1.1980, *B.W. & G.C. Hayward* (AK-155108); Whangarei Co., Hen Island, Dragon Mouth, 8.1977, *B.W. & G.C. Hayward* (AK-161844, AK-165876), Hen and Chicken Islands, Lady Alice Island, Korilnaks Bay, 1.1982, *B.W. Hayward* (AK-168409), Broken (Pig) Islands, Rangiahua (Flat) Island, 1.1985, *B.W. & G.C. Hayward* (AK-172637); Great Barrier Island, Tryphena, 36°01'S, 175°02'E, 1.1984, *B.W. Hayward* (AK-178041, AK-178131); Poorknights Islands, Aorangi Island, Pinakitanga Point, 8/9.1984, *B.W. Hayward* (AK-191311); Auckland, Kawakawa Bay, E of Auckland, Papanui Point, 36°56'S, 175°13'E, 8.1.1985, *H. Mayrhofer 5897 & G.J. Samuels* (GZU, hb. Mayrhofer); S Auckland, Coromandel Peninsula, 14 km SE of Whitanga, Hot Water Beach, 36°53'S, 175°49'E, 5 m alt., 22.5.1981, *L. Tibell 13141* (UPS); Southern Part: Thames Co., Rabbit Island, 8.1973, *B.W. & G.C. Hayward* (AK-155023), Penguin Island, 8.1973, *B.W. & G.C. Hayward* (AK-155074, AK-155075).

No. 7: Lecanora impressa (Krempelh.) Zahlbr.
AUSTRALIA, Northern Territory, Umbrawarra Gorge, 22 km SW of Pine Creek, 13°58'S, 131°42'E, 210 m alt. Steep sided rocky gorge with *Melaleuca*, *Bychotria* etc. On S-exposed, shaded sandstone with *Biatora sorediosa* (c. ap.), *Parmotrema praesorediosum*, *Pyxine* spp., 17.VII.1991, H.T. Lumbsch, J.A. Elix & H. Streimann.

L. impressa is a pantropical species, which is quite common on siliceous rocks in small creeks or other wet places in Northern Australia. The species is characterized by its aspicilioid immersed apothecia and dark reddish-brown disks without granules (=*glabrata*-type according to Brodo 1984).

Rambold (1989) mentioned the presence of several chemical races. The specimen distributed here contains atranorin and zeorin as major substances and unidentified triterpenoids and fatty acids.

No. 8: Lecanora pannonica Szatala
GERMANY, Rheinland-Pfalz, Eifel Mts, Kr. Mayen-Koblenz, Monreal, Löwenburg, 360 m alt. On exposed schists in the *Lecanoretum rupicolae*, 20.VI.1992, G.B. Feige & B. Mies.

This European species has largely been overlooked. It was treated under the name *Lecanora caesiosora* by Poelt & Vezda (1981). However, the type of *L. caesiosora* differs in morphology and chemistry. An exhaustive treatment of the species and related ones is in preparation by Brodo & Lumbsch. The specimens distributed contain atranorin and gangaleoidin as major and norgangaleoidin and chloroatranorin as minor compounds.

No. 9: Lecanora rubicunda Bagl.
Spain, CANARY ISLANDS, La Palma, between Puntalluna and Los Sauces, road to Cubo de la Galga, 28°45'N, 17°45'W, 300-400 m alt. Corticolous, 26.VIII.1992, G.B. Feige, H.T. Lumbsch & S. Huneck.

Syn. nov.: *Lecanora agustini* Erichsen, Hedwigia 66: 278 (1926). Type: Spain, Canary Islands, "Teneriffa, oberhalb San Diego del Monte bei Laguna", 20.3.1917, L. Lindiger (HBG-holotype).

Lecanora ochraceorosea R.G. Werner, Bull. Soc. Sci. Nat. Maroc 19: 53 (1939). - Type: Marocco, "sur *Pistacia lentiscus* dans umbois marabodique à l`E de Tanger au Cap Malabata", 13.7.1936, R.G. Werner (BCC-holotype).

Lecanora sylvestris (Nyl. in Stizenb.) Zahlbr., Catal. Lich. Univ. 5: 579 (1928). - *L. subfusca* f. *sylvestris* Nyl. in Stizenb., Bot. Zeitung 26: 892 (1868). Type: Madera, 1865, Mandon (H-NYL 27504-lectotype, selected here).

L. rubicunda is not uncommon in the Western part of the Mediterranean region and in Macaronesia. In La Palma it was found to be one of the commonest corticolous *Lecanora* species. The distribution of the species seem to be restricted to the Mediterranean area in a wide sense. The species is characterized by an amphithecium with large crystals belonging to the *pulicaris*-type by Brodo (1984), an epihymenium with large crystals, which appear bright whitish to yellowish under polarized light

(=*chlarotera*-type according to Brodo 1984) and the presence of the norstictic chemosyndrome in addition to atranorin. HPLC and TLC examination of the species revealed norstictic acid and atranorin as major substances and connorstictic acid and chloroatranorin as minor substances. Stictic and menegazziaic acids are present only in traces (Fig. 10). Furthermore some triterpenoids, which could not be identified are visible on the TLC plate. The major triterpenoid spot had R_f-values of 0.63 in solvent A (according to Culberson 1972) and 0.54 in solvent C.

The type material of *L. rubicunda* was not available for examination from MOD and also I.M. Brodo (in litt.) has not studied the type. However, Nimis & Poelt (1987) gave an exhaustive description of the type material, which agrees well with our understanding of this taxon. *L. rubicunda* shows some variation in the colour of the disks. While some specimens have bright reddish-brown to yellowish-brown disks, others have dark brown disks. However, the colour of the disks may vary within one specimen. I.M. Brodo (in. litt.) studied several specimens and could not find any correlating character. In La Palma we were able to collect specimens with disks of various colours, and found that the colour of the disks varies within one population. Disk colour, therefore, is not considered to be of any taxonomic value in this species. The type of *L. sylvestris* is a specimen with relatively dark disks, but *L. agustini* and *L. ochraceorosea* have bright disks.

No. 10: Lecanora rupicola ssp. subplanata (Nyl.) Leuckert & Poelt
GERMANY, Rheinland-Pfalz, Eifel Mts., TK 25: 5609, Kleiner Katzenberg near Mayen, 290 m alt. On exposed siliceous rocks in the Lecanoretum rupicolae, VIII.1991, G.B. Feige.

This subspecies of *L. rupicola* has been treated recently in some depth by Leuckert & Poelt (1989). The difference to the nominal subspecies is the presence of chloroxanthones in addition to roccellic acid, the sordidone and atranorin chemosyndromes. No morphological or geographical differences could be found.

By HPLC and TLC we could detect as major substances sordidone, atranorin, thiophanic and roccellic acids; as minor compounds eugenitol, 2,5,7-trichloronorlichexanthone and chloroatranorin and traces of 5-chloronorlichexanthone, 7-chloronorlichexanthone, 2,5-dichloronorlichexanthone, 2,7-dichloronorlichexanthone, 5,7-dichloronorlichexanthone and traces of unknowns (Fig. 11). The trace substances have not been recorded from this taxon before.

No. 11: Lecanora salicicola H. Magn.
SWITZERLAND, Tessin, TK 25: 1252 Ambri-Piotta, Lukmanierpass, Val Termine, 2000-2200 m alt., apine heathland. On old stems of *Rhododendron ferrugineum*, 22.VIII.1990, E. & H.T. Lumbsch.

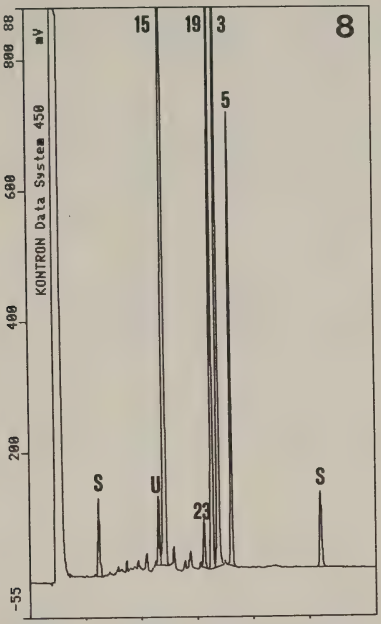
Hinteregger et al. (1989) clarified the application of this species name. *L. salicicola* is a common species in Scandinavia and on *Rhododendron ferrugineum* in the Alps, but has often been misnamed as *L. migdina* (Poelt & Vezda 1981, Wittmann & Türk 1990). However, the type of *L. migdina* differs in having much larger apothecia with undulate margins and contains the gangaleoidin chemosyndrome in addition to atranorin. More-

Tab. 1. List of the secondary metabolites detected in the illustrated chromatograms (Figs. 8-15) and their retention indices (RI) according to Feige et al. (1992).

1=Alectoronic acid	Depsidones	26
2=Arthothelin	Xanthone	35
3=Atranorin	Depside	38
4=Calycin	Pulvinic acid derivate	47
5=Chloroatranorin	Depside	42
6=4-Chloronorlichexanthone	Xanthone	21
7=7-Chloronorlichexanthone	Xanthone	24
8=Connorstictic acid	Depsidone	03
9=3,5-Dichloro-2'-O-Methylanziaic acid	Depside	32
10=2,4-Dichloronorlichexanthone	Xanthone	29
11=2,5-Dichloronorlichexanthone	Xanthone	27
12=2,7-Dichloronorlichexanthone	Xanthone	28
13=5,7-Dichloronorlichexanthone	Xanthone	30
14=Eugenitol	Chromone	08
15=Gangaleoidin	Depsidone	21
16=Gyrophoric acid	Depside	25
17=Isoarthothelin	Xanthone	36
18=Lecanoric acid	Depside	14
19=Leoidin	Depsidone	36
20=Menegazziaic acid	Depsidone	05
21=Norstictic acid	Depsidone	12
22=Placodiolic acid	Usnic acid derivate	27
23=Skyrin	Anthraquinone	31
24=Sordidone	Chromone	13
25=Stictic acid	Depsidone	06
26=Thiophanic acid	Xanthone	44
27=2,4,7-Trichloronorlichexanthone	Xanthone	37
28=Usnic acid	Usnic acid	36
29=Variolaric acid	Depsidone	03

ver the spores have a different size - 12-15.5 x 7.5-10 µm in *L. migdina*, but 11.5-16.5 x 5-7 µm in *L. salicicola*. In *L. salicicola* using HPLC and TLC we could detect atranorin and roccellic acid as major and chloroatranorin as minor compounds, as well as unidentified triterpenoids. A good colour photograph has been published by Wittmann & Türk (1990: 53).

Figs. 8-11. HPLC chromatograms. 8. *Lecanora gangaleoides*, 9. *L. garovaglii*, 10. *L. rubicunda*, 11. *L. rupicola* ssp. *subplanata* (U=unknown substances, S= standards, for the identity of the peaks see table 1; for details see text).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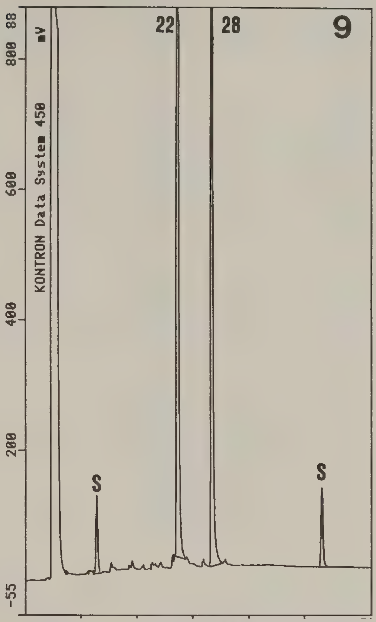
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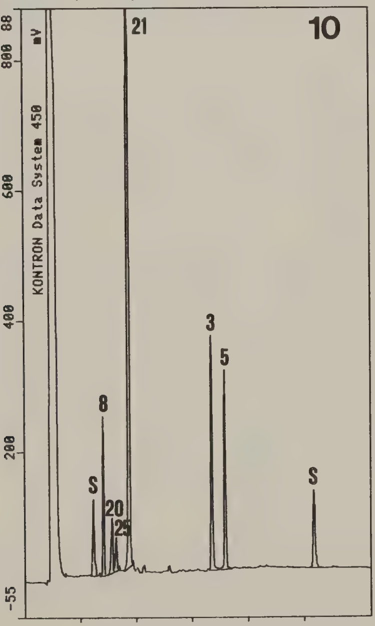
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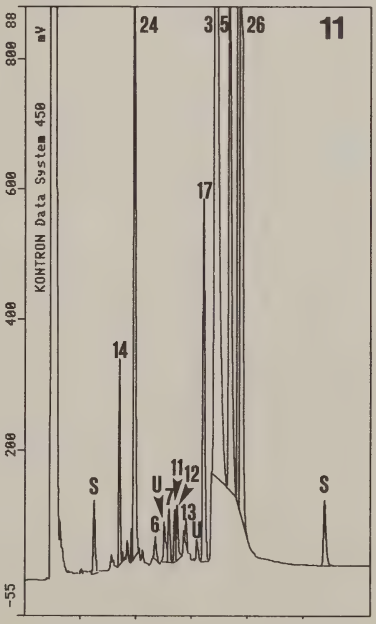
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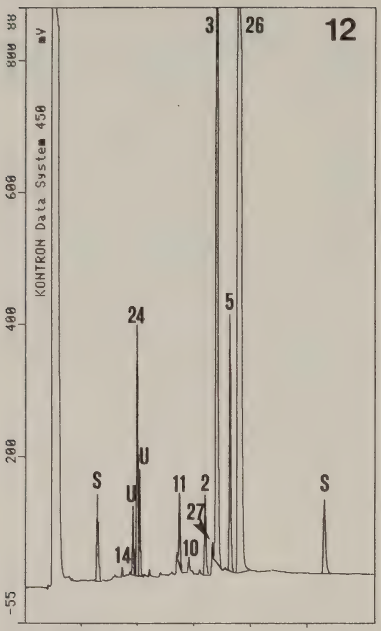
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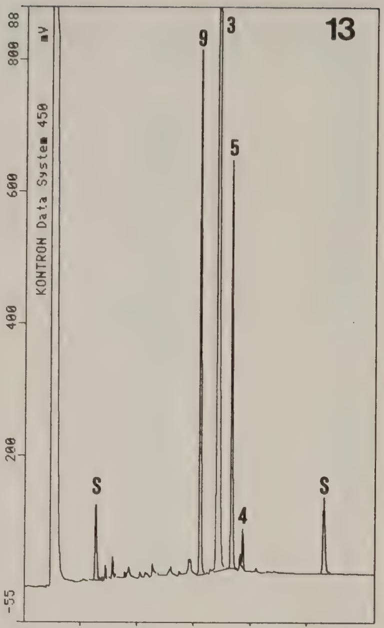
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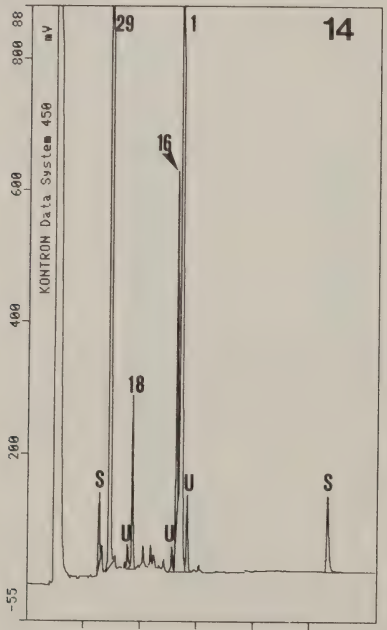
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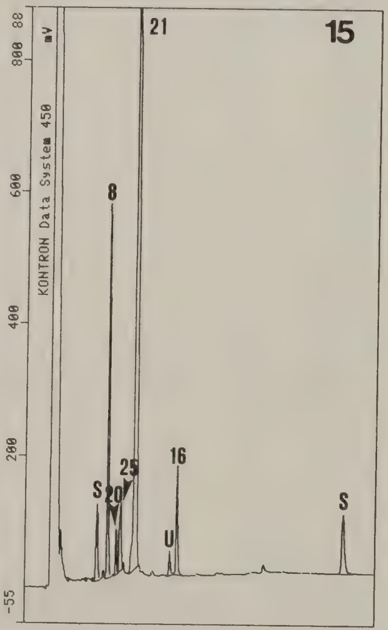
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No. 12: Lecanora sphaerospora Müll. Arg.

AUSTRALIA, Victoria, Western District, Hummocks Road, Yamhuk, 38°30'S, 142°10'E, 20 m alt. Pasture land. On limestone with *Buellia subalbula*. *Lecanora dispersa* and *Verrucaria* spp., 27.VII.1991, H.T. Lumbsch & W.H. Ewers.

Lecanora sphaerospora is very common on exposed limestone in Southern Australia. It covers large areas of the rock surface together with *Buellia subalbula*. Using HPLC and TLC we found atranorin and zeorin as major substances and chloroatranorin as minor compound, as well as other unidentified triterpenoids and fatty acids.

No. 13: Lecanora subaurea Zahlbr.

GERMANY, Nordrhine-Westphalia, Hochsauerlandkreis, TK 25: 4616, Steinberg, 1km S of Ostwig, 51°21'N, 8°25'E, ca. 400 m alt. On siliceous rocks with *Acarospora sinopica*, *Lecanora swartzii* etc., 01.III.1992, G. B. Feige and H. T. Lumbsch.

This chalcophilous taxon has been discussed by Poelt & Ullrich (1964) under the name *L. hercynica*. It contains zeorin, rhizocarpic acid, pannarin and several unidentified triterpenoids.

No. 14: Lecanora sulphurata (Ach.) Nyl.

TURKEY, Anatolia, Prov. Izmir, Çesme Peninsula, at the roadside between Karapinar and Balikliova, 38°24'N, 26°37'E, alt. ca. 10 m. On siliceous rocks with *Diploschistes caesioplumbeus*. *D. euganeus*. *Lecanora bolcana* etc., 11.IV.1992, H. T. Lumbsch.

L. sulphurata has been treated as a subspecies of *L. rupicola* by Leuckert & Poelt (1989), but we prefer to keep this taxon as a distinct species, because *L. sulphurata* is easily recognized by its morphology: the yellowish-green thallus and bluish pruinose disks. Furthermore the distribution of *L. sulphurata* differs from *L. rupicola*. *L. sulphurata* is restricted in its distribution to the Mediterranean region and does not occur in Central Europe.

The chemistry of *L. sulphurata* has been examined in detail by Leuckert & Poelt (1989) and Elix & Crook (1992). The chemical compounds of that species seem to differ somehow between the populations. By HPLC and TLC we found sordidone, atranorin, chloroatranorin and thiophanic acid as major, two unknown chromones, 2,5-dichloronorlichexanthone and arthothelin as minor substances and eugenitol, 2,4-dichloronorlichexanthone and 2,4,7-trichloronorlichexanthone in traces (Fig. 12). 2,4-dichloronorlichexanthone and 2,5-dichloronorlichexanthone have not been reported from that species previously. We could not detect isoarthothelin, which was found by Elix & Crook (1992) in a specimen from Bulgaria.

Figs. 12-15. HPLC chromatograms. 12. *Lecanora sulphurata*, 13. *L. sulphurella*, 14. *Ochrolechia parella*, 15. *Protoparmelia petraeoides* (U=unknown substances, S= standards, for the identity of the peaks see table 1; for details see text).

No. 15: Lecanora sulphurea (Hoffm.) Wahlenb.
FRANCE, Brittany, Finistere, Pointe Run Glas, NW of Le Prajou, 0-10 m alt. On siliceous rocks, in xeric supralittoral, 30.IX.1990, G.B. Feige & H.T. Lumbsch & K. Schmitz.

No. 16: Lecanora sulphurella Hepp
Spain, CANARY ISLANDS, La Palma, Los Llanos de Aridane, ca. 300 m above Celta, succulent steppe on old lava field, ca. 500 m alt. On basaltic rocks with *Acarospora heufleriana, Caloplaca scoriophila, Stereocaulon vesuvianum, Thelomma mammosum* and *Xanthoria resendei* etc., 19.III.1992, G. B. Feige, H. T. Lumbsch and S. Huneck.

Lecanora sulphurella is a Macaronesian element and its distribution was mapped by Follmann (1976). The species contains atranorin, chloroatranorin and 3,5-dichloro-2'-o-methylanziaic acid as major and calycin as minor substance (Fig. 13). We were unable to detect arthothelin or any other xanthone in this specimen and also in other specimens of that species studied chemically. Arthothelin was recorded for that species by Hertel (1989) in a specimen collected in Madera.

No. 17: Lobothallia radiosa (Hoffm.) Hafellner
AUSTRALIA, New South Wales, Careys Cave, 4.5 km NNE of Wee Jasper, 35°05'S, 148°39'E, 380 m alt. Large limestone outcrops with scattered *Brachychiton* in pasture land. On limestone with *Buellia subalbula, Collema novaezelandicum, Diploschistes gypsaceus, Placynthium subradiatum* etc., 12.VIII.1991, H.T. Lumbsch & H. Streimann.

Lobothallia radiosa is a fairly common lichen on limestone in Europe and has been reported from North America (Egan 1987) and Australia (McCarthy 1991). The chemistry and relationships were discussed by Hermann et al. (1973). They found that the chemistry of the species is variable. While some specimens contained norstictic acid in varying amounts, others did not contain any lichen compounds. The specimen distributed here belongs to the latter chemotype. We could not detect any lichen substances by HPLC.

The relationships of the *Lobothallia radiosa* group have been discussed by Hafellner (1991), but are still not clear. Although the species show some differences from *Aspicilia* s. str.; e.g. the thallus is placodioid with effigurate lobes at the margins and the paraphyses are quite thick and simple unlike *Aspicilia* s.str., there are other characters such as the spore size and the pigmentation of the epihymenium which also differ within *Aspicilia*. We follow Hafellner with some hesitation and hope that the relationships to other species within *Aspicilia* will be clarified by further examinations of the still poorly known species of *Aspicilia*.

No. 18: Ochrolechia parella (L.) Massal.
FRANCE, Brittany, Finistere, Moulin de la Rive, W of Locquirec, 0-20 m alt. On siliceous rocks, in xeric supralittoral, 01.X.1990, H.T. Lumbsch & K. Schmitz.

A common subatlantic species in Europe and the Mediterranean, probably erroneously recorded from the Southern Hemisphere. By HPLC and TLC we found alectoronic, gyrophoric and variolaric acids as major, lecanoric acid as minor substances and traces of unknown depsidones, probably related to alectoronic acid (Fig. 14).

No. 19: Protoparmelia petraeoides (Nyl. ex Bab. & Mitt.) Hertel
AUSTRALIA, New South Wales, Big Badja, 46 km NE of Cooma, 36°01'S, 149°34'E, 1360 m alt. *Leptospermum-Kunzea* heathland on rocky summit. On exposed siliceous rocks, 04.VIII.1991, H.T. Lumbsch, J.A. Elix and H. Streimann.

An exhaustive description of this species is given by Rambold (1989). The species has been recorded from mediterranean parts of Australia, the South island of New Zealand, Tasmania, South Africa and also from Sardinia. By HPLC and TLC we could detect norstictic (major), connorstictic (minor) and, in traces, menegazziaic, stictic and gyrophoric acids and an unidentified depside, which is probably identical with ovoic acid (Fig. 15). The trace substances were not mentioned by Rambold (1989).

No. 20: Tephromela atra (Hudson) Hafellner
Australia, New South Wales, Wolumba Peak, 16 km WNW of Merrimbula, 36°53'S, 149°44'E, 750 m alt. Dry sclerophyll forest on rocky ridge, often burnt. On basaltic rocks with *Diploschistes euganeus*, *Pertusaria lophocarpa* and *Rhizocarpon geographicum* 16.VI.1991, H.T. Lumbsch & H. Streimann.

A common and cosmopolitan species occuring on both rocks and bark or wood. However, the species is quite variable and it may be necessary to carve up natural populations as distinct species in the future. By HPLC and TLC we found alectoronic acid and atranorin as major, a-collatolic acid and an unidentified depsidone related to alectoronic acid as minor compounds.

We wish to thank the curators of the cited herbaria and the private collectors for sending us specimens in their care for examination. The assistance of all those who helped with the collection of the specimens, by collecting or organizing excursions, especially Mrs. J.A. Curnow, Dr. J.A. Elix, Dr. W.H. Ewers, Dr. R.B. Filson, Dr. G.Gärtner, Dr. S. Huneck, Dr. V. John, Dr. B. Mies, Mrs. S. Paus and Mr. H. Streimann, is gratefully acknowledged. Dr. J.A. Elix is thanked for the verification of the identity of leoidin and norgangaleoidin. We especially thank Dr. I.M. Brodo, who kindly reviewed our manuscript and helped us with the species circumscription of *Lecanora rubicunda*.

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THE EPICORTICAL STRUCTURE OF THE LICHEN GENUS PSILOPARMELIA (PARMELIACEAE: ASCOMYCOTINA)

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ABSTRACT: The parmelioid genus *Psiloparmelia* which was recently segregated from *Xanthoparmelia* and has a mainly neotropical distribution is shown to have a rudimentary pored epicortex. For the most part the upper surface is non-epicorticate, but in some areas a rudimentary epicortex is apparent.

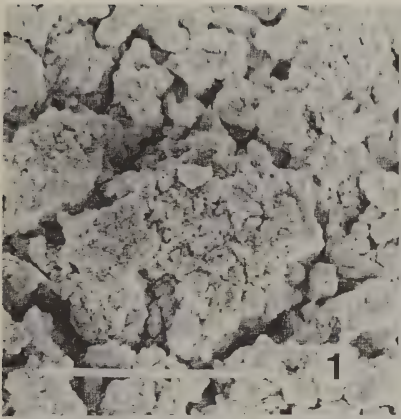
The large heterogeneous foliose lichen genus *Parmelia* Ach. s. lat. was segregated into several smaller genera by a number of authors (Culberson & Culberson 1968, 1981, Esslinger 1978, Hale 1974a, 1974b, 1974c, 1974d, 1976, Krog 1982 and Sipman 1980). One of these new genera was *Xanthoparmelia*. Further investigations have shown that this genus, like other segregates of *Parmelia* s. lat., was still heterogenous and consequently the new genera *Arctoparmelia* (Hale 1986), *Namakwa* (Hale 1988), *Psiloparmelia* (Hale 1989a) and *Karoowia* (Hale 1989b) were proposed. *Arctoparmelia* is a small group of arctic to boreal saxicolous lichens in the Northern Hemisphere, while both *Namakwa* and *Karoowia* occur in semi-arid to arid regions in the Southern Hemisphere, mainly South Africa. Both *Karoowia* and *Namakwa* are unique within the parmelioid genera as regards their morphology. Thus *Karoowia* exhibits subcrustose to effigurate thalli while *Namakwa* has strange structures in the upper cortex, which were interpreted as modified pseudocyphellae by Hale (1988).

The genus *Psiloparmelia* is distributed mainly in South America with only one species from Southern Africa. Hale (1989a) considered the following characters as being important for distinguishing this new genus - the high concentration of usnic acid and atranorin in the upper cortex, the velvety lower surface, the lack of rhizines and a negative test for lichenan. While two of us (JAE & THN) were undertaking a monographic treatment of *Psiloparmelia*, we became interested in the structure of the thallus surface in this genus. Hale (1989a) reported the upper surface of the cortex of this genus as being a typical pored epicortex, but we found this to be an over-simplification. The structure of the upper surface in this genus has now been shown to be quite unique for the parmelioid genera and our results are presented below.

Material and Methods

List of *Psiloparmelia* specimens examined: *P. denotata* Elix & Nash ined. - Peru, Dept. Lima, Prov. Huarochiri. On rocks, valley of Río Santa Eulalia, NE of Carampoma, ca. 3700 m alt., 11°38'S, 76°27'W, 15.2.1981, *R. Santesson & R. Moberg P24:4A* (S); *P. dichotoma* Elix & Nash ined. - Peru, Dept. Huanuco, Prov. Dos de Mayo, valley of Río Maranon, ca. 58 km (road distance) WNW of Huanuco, 9°48'S, 76°40'W, ca. 3900 m alt., 24.2.1981, *R. Santesson & R. Moberg P50:42* (S); *P. flavobrunnea*(Müll.Arg.) Elix & Nash ined. - Ecuador, Napo, between Quito and Baeza, ca. 50 km NW of Baeza, in páramo vegetation, 4000 m alt., 8.9.1987, *K. & A. Kalb 18604* (ANUC); *P. norstictica* Elix & Nash ined. - Argentina, Jujuy Prov., on acidic rocks, 28 km N of Humahuaca along route 9, 65°22'W, 23°00'S, ca. 3300 m alt., 28.5.1989, *T.H. Nash 27930A* (ASU).

Figs. 1-6. SEM photographs of upper surfaces of thalli of parmelioid lichens. Figs. 1 & 2. *Psiloparmelia denotata* ined. (R.Santesson & R.Moberg P24:4A); Fig. 3. *P. flavobrunnea* (Kalb 18604); Fig. 4. *P. norstictica* (Nash 27930A); Figs. 5 & 6. Pored epicortices of *Paraparmelia* and *Xanthoparmelia*; Fig. 5. *P. lithophiloides* (Elix exs. 138); Fig. 6. *X. cheelii.* (Scales. 1=20μm; 2=100 μm; 3 & 6=50 μm; 4=200 μm and 5=40 μm).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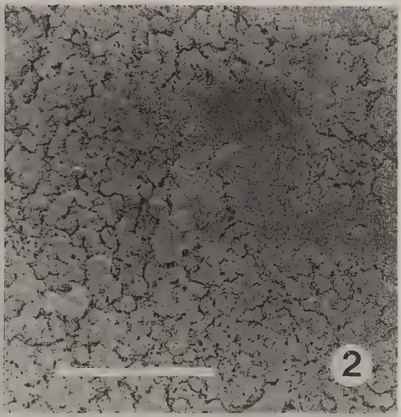
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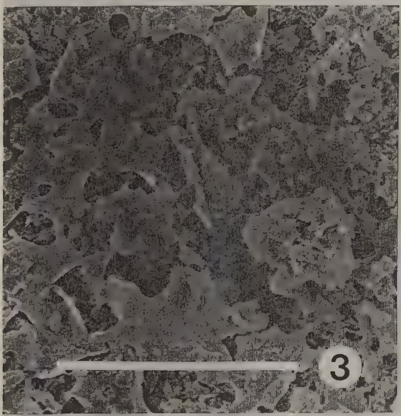
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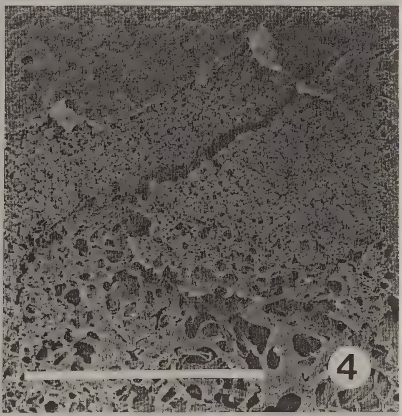
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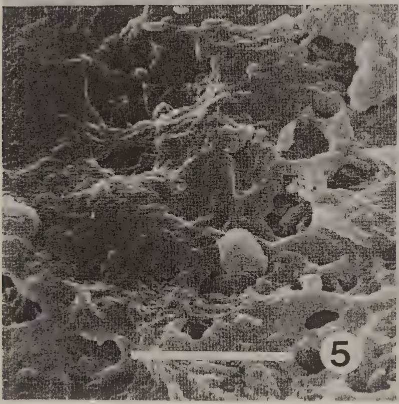
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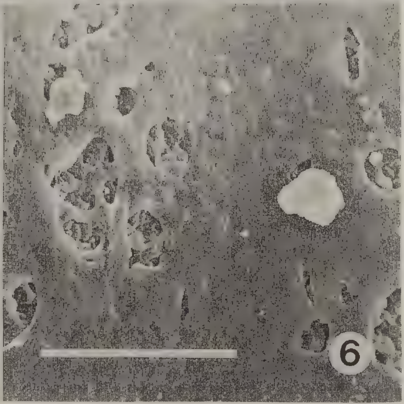
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For comparision the following specimens of parmelioid genera with a well developed pored epicortex were examined: *Neofuscelia glabrans*: Australia, ACT, Gudgenby River Gorge, 4.5 km S of Tharwa, 35°34'S, 149°04'E, ca. 620 m alt., 10.4.1983, *J.A. Elix 10905* (hb. Lumbsch); *Paraparmelia lithophiloides*: Elix, Lich. Australas. exs. 138 (hb. Lumbsch); *Xanthoparmelia bellatula*: Australia, New South Wales, 11 km E of Mildura, along Sturt Hwy, 34°17'S, 142°15'E, ca. 40 m alt., 22.12.1983, *J.A. & M.J. Elix 11486* (hb. Lumbsch) and *Xanthoparmelia cheelii*: Australia, ACT, Gudgenby River Gorge, 4.5 km S of Tharwa, 35°34'S, 149°04'E, ca. 620 m alt., 10.4.1983, *J.A. Elix 10907* (hb. Lumbsch).

Scanning electron microscopy was carried out according to Lumbsch & Kothe (1988). A Cambridge Stereoscan 200 SEM was used.

Results and Discussion

In the present work SEM studies of the *Psiloparmelia* specimens examined established the presence of a rudimentary or undeveloped epicortex. For the most part, the upper surface of the thallus lacked an epicortex altogether - this was particularly so towards the margins. No epicortex was observed on the marginal lobes of any of the specimens examined - instead the direct upper cortical surface was observed (Fig. 1), often covered by crystals of lichen substances. In the central part of the thalli a continuous layer was visible with a few pores or none at all. In the smaller thalli such areas were limited to the centre of the lobes (Fig. 2), while in larger thalli the epicortex could be seen forming small patches over the upper cortex (Fig. 3). These patches obviously merged to form a continuous epicortical layer in the centre of the thallus. The epicortex in the area between the centre of the thallus (with the continuous layer) and the margins (lacking an epicortex) looked very similar to the structures observed in the "parmotremoid" Parmeliaceae, that is the pored epicortex. Thus Hale's interpretation of the upper surface of *Psiloparmelia* as belonging to the pored epicortical type (Hale 1973) is easy to understand. However, our investigations as described above, indicate that this is an oversimplification of the structures observed in *Psiloparmelia*.

Indeed, we observed that the epicortical layer was actually eroded off in damaged areas of the thallus (Fig. 4). In these areas the upper surface which now lacked the epicortical layer, looked very similar to the margins of the thallus, thus supporting our interpretation above.

For comparision we re-examined some other representatives of the "parmotremoid" Parmeliaceae reported to have a pored epicortex. We could not find any epicortex-free zones in these lichens as was observed in *Psiloparmelia* (Figs. 5 & 6). The upper surface of all representatives of the genera *Neofuscelia*, *Paraparmelia* and *Xanthoparmelia* examined exhibited a typical pored epicortex as defined by Hale (1981). Here the pores in the polysacharide layer appear to be developed secondarily and are not blank areas where the epicortex has not developed.

In conclusion these observations provide further evidence for the generic independence of the genus *Psiloparmelia*, a genus which has now been found to be much richer in species than had previously been appreciated (Elix & Nash 1993).

Acknowledgements

We wish to thank the curators of the cited herbaria for their kind cooperation and Dr. Klaus Kalb for sending us specimens from his private herbarium on loan. Dr. T.L. Esslinger is thanked for reviewing the manuscript. The latter two authors also gratefully acknowledge the financial assistance of the U.S. National Science Foundation grants BSR-8820016 and BSR 89-43558 to Arizona State University.

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HEBELOMA NAVICULOSPORUM SP. NOV. IN PENINSULAR SPAIN

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Abstract.– *Hebeloma naviculosporum* is proposed as a new species. It is characterized, principally, by its narrow and fusiform spores, as well as by its very short cylindrical cheilocystidia. Its taxonomic position is discussed and it is compared with taxonomically related taxa.

MATERIAL AND METHODS

The material studied has been collected in the province of Guadalajara (Spain). The microscopical examinations have been carried out in water, NH_4OH 10%, Congo Red and Melzer's reagent. It has been deposited at the Herbarium of the University of Alcalá de Henares (H.AH).

The spore measurements have been made without considering the perisporium or calyptra. The method followed by us to make these measurements as well as to characterize the spores is the one proposed by HEINEMANN & RAMMELOO (1985). For this purpose we have measured 38 mature spores (n=38) lying on a gill of a mature specimen, and mean values (x) of length (L), width (l) and Q coefficient (L/l) as well as their corresponding standard deviations (σ) were calculated. The values which are higher or lower than $x \pm 2\sigma$ are represented in brackets. The SEM photographs have been carried out with a Zeiss-950 microscope, using the critical point technique.

Hebeloma naviculosporum Heykoop, Moreno & Esteve-Raventós sp. nov. (Fig. 1-2)

Pileus usque 3,5 cm diam., plano-convexus, ochraceo aurantiacus sive fuscus, viscidus. Stipes usque 5,5 x 0,6 cm, cylindraceus, albidus. Laminae emarginatae eius caro albida, colore fusco usque basim stipitis. Odore terroso cum scissio fit.

Sporae 10-13,8(14,5) x (4)4,5-5,1(5,5) μm, naviculares, confertim fusiformes, verrucosae, ochraceo-castaneo colore. Basidia tetrasporica, 27-40 x 6-7 μm. Pleurocystidia absentia. Pileipellis hyphis, 2,5-5 μm diam., fibulatis constituta.

Habitat: sub pino sylvestri, apud Sphagnum sp., inter Condemios de Abajo et Aldeanueva de Atienza, 4-X-91, leg. M. Heykoop et G. Moreno, Holotypus H.AH 14256.

Pileus up to 3.5 cm in diam., applanate-convex, uniformly orange-ochraceous to brown, viscid. Stipe up to 5.5 x 0.6 cm, cylindrical, whitish, pruinose at the apex, with fugacious small remnants of the universal veil. Gills moderately crowded, emarginate, not ventricose, fresh colour not recorded, in exsiccata not very dark brownish; gills not exuding droplets. Flesh whitish in the pileus and the upper half of the stipe, more or less pale brown in its lower half. Smell earthy when cut. Taste not recorded. Spore print ochraceous-brown.

Spores 10.0-11.77-13.8(14.5) x (4.0)4.5-4.78-5.1(5.5) μm, Q= 2.00-2.46-2.97(3.12) (n=38); very long and narrow, navicular, narrowly fusiform to slightly and narrowly amygdaliform, with rounded apical papilla, warted, with a perisporium which may loosen forming a calyptra, ochraceous-brown, dextrinoid in Melzer's reagent. Basidia 4-spored, clavate, 27-40 x 6-7 μm, with sterigmata up to 6.5 μm in length. Gill-edge white, covered by cheilocystidia which are colourless, cylindrical to slightly clavate, 21-40 x 5-6.5 μm. Pleurocystidia not observed. Pileipellis consisting of an ixocutis, with clamped-hyphae up to 2.5-5 μm in diam., with pale yellowish intracellular pigment. This cutis passes progressively into an hipocutis with pseudoparenchymatous aspect constituted by wide and short hyphae, up to 27 μm in diam., with a strong membranal pigment which sometimes is strongly encrusting. Hymenophoral trama regular, formed by more or less parallel hyphae, up to 10 µm in diam., with pale yellow-brown, membranal pigment. Subhymenium formed by more or less isodiametrical, very short, elements, up to 5 µm in diam.

Material examined: Guadalajara, between Condemios de Abajo and Aldeanueva de Atienza, under *Pinus sylvestris*, close to *Sphagnum* sp. peat bog, 4-X-91, leg. M. Heykoop & G . Moreno, H.AH 14256.

DISCUSSION

Among all the European and Northamerican species described in *Hebeloma* up to date, none fits the set of microscopical characters of the proposed new species (ROMAGNESI, 1965 AND 1983; BRUCHET, 1970; HESLER, 1977; SMITH, 1984 etc.).

VESTERHOLT (1989) classifies the European *Hebeloma* species into three sections, i.e. *Hebeloma* (Fr.) Sing. s. Vesterholt (= *Denudata* (Fr.) Sacc.) whose species are characterized by the lack of pseudorhiza and velum partiale and the presence of a more or less rafanoid smell, *Indusiata* (Fr.) Sacc., characterized by the presence of velum partiale (cortina) and the absence of calyptrate spores, and *Myxocybe* (Fayod) Konr. & Maubl., characterized by the non-rafanoid smell of all its species and the general presence of a pseudorhiza.

Our species is characterized by the absence of velum partiale, its navicular and narrowly fusiform spores with a perisporium which loosens, and the absence of a rooting stipe. We, therefore, include it in section *Hebeloma* s. Vesterholt. This section is rather heterogeneous, grouping some very different species (VESTERHOLT, l.c.). Most of the taxa belonging to the latter section show rather long and clavate to clearly capitate cheilocystidia (generally longer than 45 µm). *H. naviculosporum* is characterized, however,

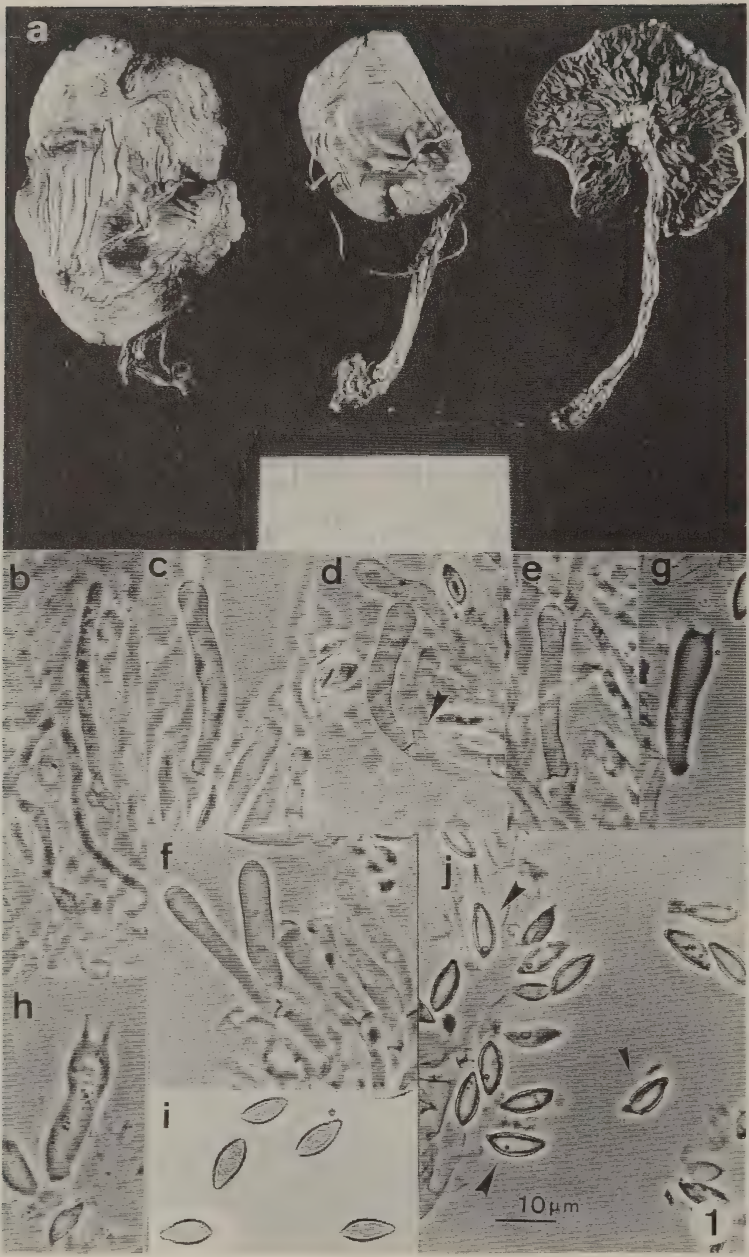
a
b
c
d
e
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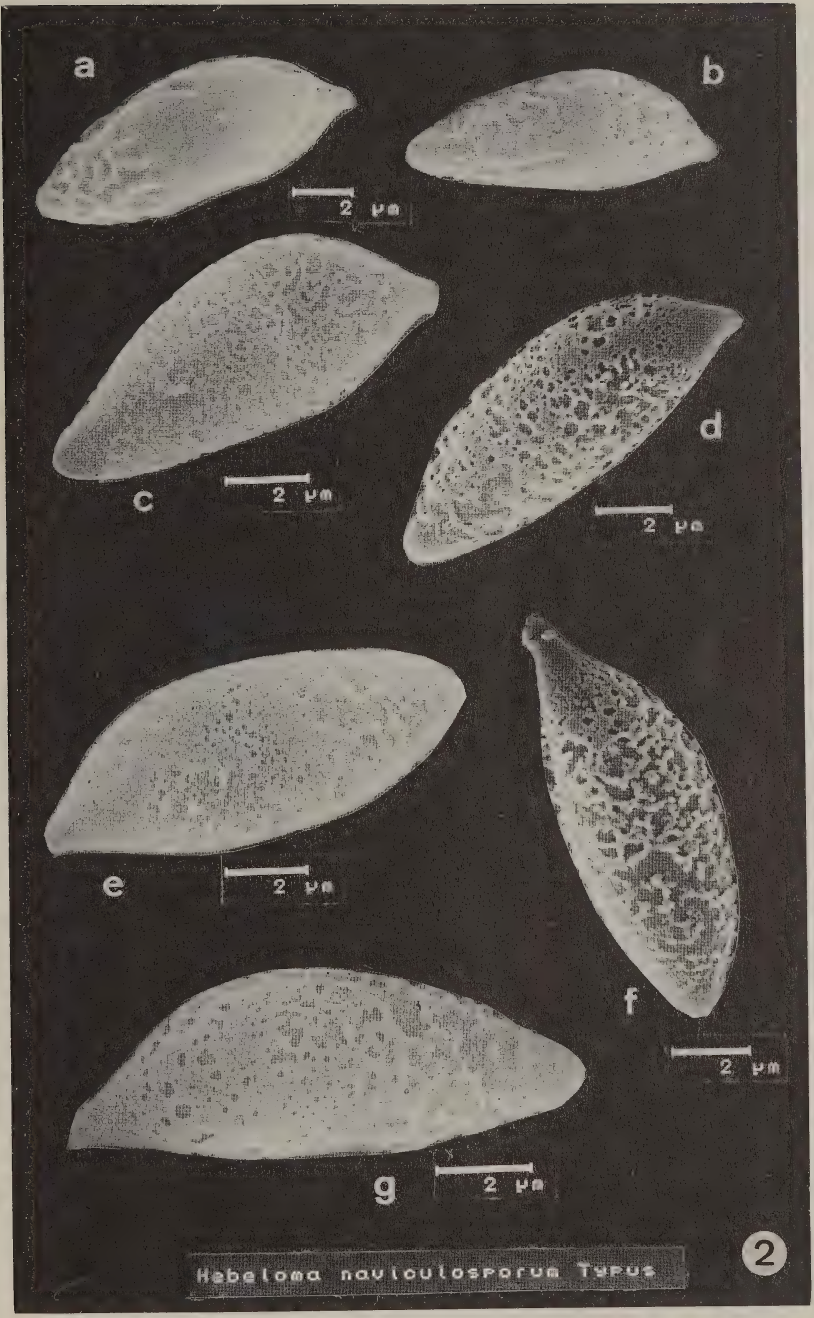
Fig.– 1 *Hebeloma naviculosporum* Typus. a: Carpophores. b: Pileipellis. c-f: Cheilocystidia. g-h: Basidia. i-j: Spores.


a
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2 µm
c
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d
2 µm
e
2 µm
f
2 µm
g
2 µm
2
Hebeloma naviculosporum Typus

Fig.– 2 *Hebeloma naviculosporum* Typus. a-g: spores.

by its cylindrical to slightly clavate cheilocystidia which are shorter than 40 µm.

According to VESTERHOLT (l.c.) the features of the spores are very important for the delimitation of *Hebeloma* species. Moreover, according to ROMAGNESI (1965), the specific delimitation must be based fundamentally on the spores and the cheilocystidia.

H. naviculosporum may remind in a way the American species *H. angustisporium* Hesler, which also presents narrow and fusiform spores (HESLER, l.c.); nevertheless they differ macroscopically because of the presence in *H. angustisporium* of a pale pileus with whitish margin, as well as the presence of pleurocystidia. Besides, our species shows spores which are significantly longer, 10-13.8(14.5) x (4)4.5-5.1(5.5) µm (Q=2-3), versus (7.5)8-9 x (3.5)4-4.5 µm (Q=2) in *H. angustisporium*.

Another taxon with narrow fusiform spores is *Hebeloma perangustisporium* Hesler (HESLER, l.c.), but differs from *H. naviculosporum* by its pale ochraceous pileus, smaller spores (8-10.5 x 4-5 µm) and the very little developed hipodermis.

The pileus colour of *H. naviculosporum* strongly resembles *H. vaccinum* Romagn. (ROMAGNESI, pers. com.). Nevertheless, the latter has spores which are broadly amygdaliform and its gills have a reddish hue and exude droplets. Recently we have made a study on *H. vaccinum* (ESTEVE-RAVENTOS & HEYKOOP, 1990) in which we pointed out that the value of its Q coefficient (L/l) is always less than 2, whereas in *H. naviculosporum* it is (much) higher than 2. In the aforementioned study we described *H. vaccinum* var. *cremeopallidum*, a taxon with a Q coefficient also higher than 2, but which is different, both because of its long amygdaliform and quite larger spores, (12.5)13-16(17) x (5.5)6-7(7.8) µm, and its cream-whitish pileus.

Hebeloma truncatum s. J. Lange (= *H. theobrominum* Quad.) has a similar pileus colour but its spores, though narrow, are smaller and the perisporium does not loosen (QUADRACIA, 1987).

Finally, there still exists another species with fusiform spores, i.e. *H. fusisporum* Gröger & Zschieschang which shows much larger spores and cheilocystidia, as well as a sweetish smell, similar to *H. sacchariolens* (GRÖGER & ZSCHIESCHANG, 1981).

Consequently, and taking into account the fact of only having one single collection, we think that both the sporal and cystidia characteristics justify the description of this new taxon.

ACKNOWLEDGEMENTS

We wish to express our gratitude to Prof. H. Romagnesi for studying our material and his valuable comments.

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MYCOTAXON

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A PRELIMINARY DISCOMYCETE FLORA OF MACARONESIA: PART 8, ORBILIACEAE[1]

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> "But optics sharp it needs, I ween,
> To see what is not to be seen."
> John Trumbull
> McFINGAL, Canto I, Line 67

Order HELOTIALES
Suborder HYMENOSCYPHINEAE
Family ORBILIACEAE Nannfeldt 1932

ONE KNOWN MACARONESIAN GENUS

ORBILIA Fries 1835

Notes: Though the members of this genus are exceptionally easy to recognize as belonging to the genus, species identification is exceptionally difficult and requires good oil-immersion optics and staining with cotton-blue in lactophenol for many species. Phase optics are also very helpful. An annoying complication arises in that some common names, such as O. *xanthostigma*, O. *coccinella*, and O. *botulispora* disappear, while O. *inflatula* and O. *auricolor* now have different circumscriptions, and another commonly used name, O. *curvatispora*, proves to be a synonym of the latter. Spooner's (1987) contribution is a great help, but Svrček's (1954) compilation is still very useful. There is no monograph of this genus, a job which needs desperately to be done. A future monographer will hopefully "save" O. *xanthostigma* by proposing a suitable neotype. Brian Spooner has suggested to me that O. *occulta* may belong in *Hyalinia*.

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[1] The parts of this flora will appear in irregular order. Reprints of individual parts will not be available for distribution. For special features of this flora, see *Mycotaxon* 13: 144. 1981.

Key to the known Macaronesian species

1 Paraphyses and asci not immersed in a thick gel, but separating easily; paraphyses with a ball-like globose apex; ascospores ovoid, ca. 3–5 x 2 µm; apothecia orange to red. **1. O. alnea**

1´ Paraphyses and asci embedded in a thick gel; paraphyses with or without a swollen apex; ascospores not ovoid 2

  2(1´) Ascospores botuliform, curved; apothecia dull orange. **3. O. delicatula**

  2´(1´) Ascospores not botuliform 3

3(2´) Ascospores tear-drop shaped, drawn out below; paraphyses swollen, with a cyanophilic, cap-like encrustation; apothecia reddish-orange, less than 1 mm diam. . . . . **8. O. occulta**

3´(2´) Ascospores otherwise 4

  4(3´) Ascospores broad-lunate, 4–6 x 1.5–2 µm; apothecia translucent white when fresh, yellowish dry, less than 1 mm diam; basal hyphae moniliform . . . . . . **6. O. lunata**

  4´(3´) Ascospores not broad-lunate 5

5(4´) Ascospores very narrow, at limits of optical resolution, 3–5 x 0.4–0.8 µm, asci 20–26 µm long; apothecia tiny or up to 1.5 mm diam, translucent to orange . . . . **4. O. epipora**

5´(4´) Ascospores wider; asci often longer; apothecia rarely over 1 mm diam 6

  6(5´) Ascospores curved, 10–13 x 1µm; asci over 40 µm long; apothecia pallid to orange . . . . **2. O. auricolor**

  6´(5´) Ascospores not exceeding 10 µm; asci shorter than 40 µm 7

7(6´) Apothecia orange, surrounded by white, radiating basal hyphae when dry; ascospores blunt, 4.5–7 µm long. **5. O. inflatula**

7´(6´) Apothecia pink, lacking white radiating basal hyphae when dry; ascospores fusoid, 7–10 µm long . . . . . . **7. O. luteorubella**

1. **Orbilia alnea** Velen., Monogr. Discomyc. Bohem. 1: 93. 1934.

MISAPPLIED NAMES: *Orbilia coccinella* (many authors), O. *xanthostigma* (Svrček, 1954).

RECENT TAXONOMIC TREATMENTS:

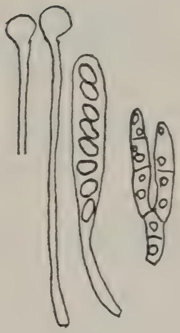
Svrček (1954, as O. *xanthostigma*), Breitenbach & Kränzlin (1984, as O. *coccinella*), Spooner (1987).

PREVIOUS MACARONESIAN RECORDS:
None.

TYPE LOCALITY: Mnichovice, Bohemia, Czechoslovakia.

KNOWN MACARONESIAN DISTRIBUTION
CANARY ISLANDS
Gomera. CUP-MM 2675.
Tenerife. CUP-MM 502A, 2726.

SUBSTRATA:
On bark, on midrib of a palm.



O. alnea, 2 paraphyses, ascus and ascospores, *Dicranidion* conidium (anamorph), CUP-MM 502A, x1000.

Notes: This is the species widely known as O. *coccinella* Auct. *non* Sommerfelt, which Svrček (1954) thought to be O. *xanthostigma* (Fr.) Fr. I somewhat reluctantly follow Spooner (1987) in treating O. *xanthostigma* as a *nomen ambiguum*, and adopt here the earliest name known for this distinctive species. It was probably described several times before 1934, and has been beautifully illustrated by Boudier (Icones Mycologicae 3: pl. 461. 1908) as O. *coccinella*.

2. **Orbilia auricolor** (Bloxam ex Berk. & Br.) Sacc., Syll. Fung. **8:** 625. 1889.

= *Orbilia curvatispora* Boudier, Bull. Soc. Mycol. France **4:** 80. 1888.

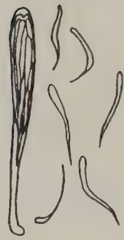
RECENT TAXONOMIC TREATMENTS:
Svrček (1954, as O. *curvatispora*), Dennis (1960, 1968, 1978, as O. *curvatispora*), Breitenbach & Kränzlin (1984, as O. *curvatispora*), Spooner (1987).

PREVIOUS MACARONESIAN RECORDS:
None.

TYPE LOCALITY:
Gopsal, Britain.

KNOWN MACARONESIAN DISTRIBUTION
CANARY ISLANDS.
Tenerife. CUP-MM 1132 (O).

SUBSTRATUM:
On [rotted wood of] living *Laurus ?* sp.



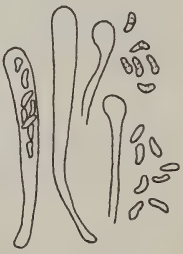
O. auricolor, ascus, 6 ascospores, CUP-MM 1132, x1000.

Notes: This species was attractively illustrated by Boudier (Icones Mycologicae 3: pl. 463. 1909) as O. *curvatispora*. The name O. *auricolor* was misapplied by Dennis (1960, 1968, 1978) to the species now called O. *inflatula* by Spooner (1987) (see species 5, below).

3. **Orbilia delicatula** (P. Karst.) P. Karst., Not. Sällsk. Fauna Fl. Fenn. 11: 248. 1870.

= *Orbilia botulispora* Höhnel, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1, **116**: 131. 1907.

RECENT TAXONOMIC TREATMENTS:
Svrček (1954, as O. *botulispora*), Dennis (1960, 1968, 1978, as O. *xanthostigma*), Breitenbach & Kränzlin (1984, as O. *xanthostigma*), Spooner (1987).



O. delicatula, 2 asci, (left CUP-MM 471B, right CUP-MM 279), 2 paraphysis apices and 8 lower ascospores (CUP-MM 93), 6 upper ascospores (CUP-MM 471B), all x1000.

PREVIOUS MACARONESIAN RECORDS:
*Beltrán et al. (1989).

TYPE LOCALITY:
Mustiala, Finland.

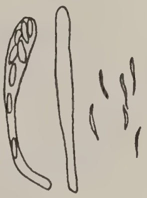
KNOWN MACARONESIAN DISTRIBUTION
CANARY ISLANDS
La Palma. CUP-MM 650 (OSC, TFC), 1095.
Tenerife. CUP-MM 93, 265A, 279, 295 (TFC, also to be issued in Korf & Gruff, *Discomycetes Exsiccati*), 471B, 557, 589, 610, 1096, 1146 (O), 1147 (O), 1154 (O), 1193, 1254, 1258 (TFC), *2623 (TFC), *2625 (TFC).

SUBSTRATA:

On decayed, or wet, or very old wood, on *Pinus insignis*, on decorticated wood of trunk of cut *Laurus azorica*.

Notes: This species was illustrated by Boudier (Icones Mycologicae 3: p. 460. 1906) as O. *xanthostigma*.

4. **Orbilia epipora** (Nyl.) P. Karst., Not. Sällsk. Fauna Fl. Fenn. 11: 248. 1870.



O. epipora, 2 asci (CUP-MM 245), 6 ascospores (CUP-MM 1145), all x1000.

RECENT TAXONOMIC TREATMENT:

Svrček (1954).

PREVIOUS MACARONESIAN RECORDS:

None.

TYPE LOCALITY:

Finland.

KNOWN MACARONESIAN DISTRIBUTION

AZORES.

Terceira. CUP-MM 2007.

MADEIRA.

Madeira. CUP-MM 1537, 2254, 2390.

CANARY ISLANDS.

Gomera. CUP-MM 2665.

Tenerife. CUP-MM 245, 273A, 299 (TFC), 434.

SUBSTRATA:

On wood, on decayed wood, on bark with pyrenomycete, on wood of *Ulex* sp., on *Myrica faya*.

5. **Orbilia inflatula** (P. Karst.) Sacc., Syll. fung. 8: 627. 1889.

MISAPPLIED NAME: *Orbilia auricolor* (Dennis 1960, 1968, 1978).

RECENT TAXONOMIC TREATMENTS:

Svrček (1954), Dennis (1960, 1968, 1978, as O. *auricolor*), Spooner (1987).

PREVIOUS MACARONESIAN RECORDS:
None.

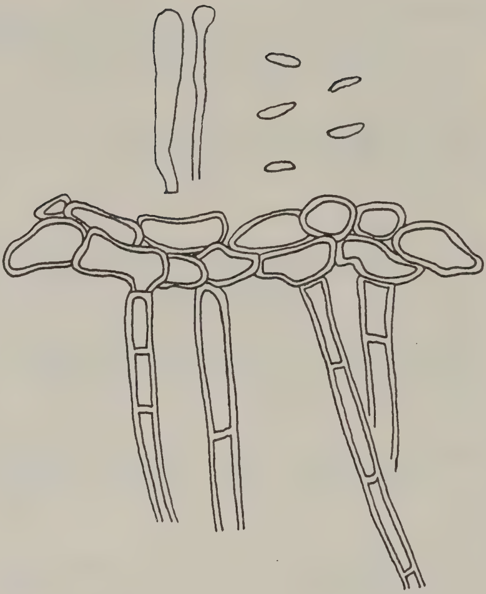
SYNTYPE LOCALITIES:
Mustiala and Pähkijärvi, Finland.

KNOWN MACARONESIAN DISTRIBUTION

AZORES.

Flores. CUP-MM 2126.
Saõ Miguel. CUP-MM 2487.

SUBSTRATA:
On stump, on wood.



O. inflatula, ascus, paraphysis, 5 spores (CUP-MM 2487), basal cells and radiating hyphae (CUP-MM 2126), all x1000.

Notes: The basal radiating hyphae, particularly evident in dried material, are quite diagnostic, and are rigid and not moniliform as in O. *lunata* (species 6 of this treatment). Spooner (1987: p. 176) cited Karsten as the author of this combination, but in the place cited Karsten treated the name at subspecific rank, and I have not found any place where he or any other author treated it at species rank in *Orbilia* prior to Saccardo's transfer.

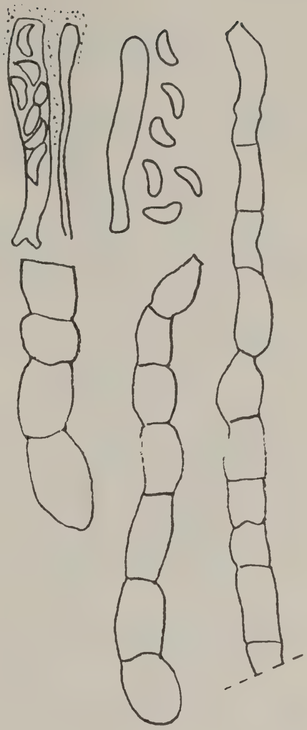
6. **Orbilia lunata** Korf, *n. sp.*

RECENT TAXONOMIC TREATMENTS:
None.

PREVIOUS MACARONESIAN RECORDS:
None.

Ab Orbilia epipora *et* O. inflatula *ascosporis late lunatis differens.*

APOTHECIA 350–750 µm diam, centrally attached by a short stipe immersed in the substrate, plane to convex and translucent white when fresh or revived, discoid to deep cupulate and yellowish when dry. FLESH typically of large-celled textura angularis. BASAL anchoring hyphae present, hyaline, often as long as 150 µm or longer, 3.7–10.2 µm wide. ASCI 8–spored, J–, cylindrical, not stalked, forked at the base, 26–30 x 3.7–4.4 µm, glued tightly in a gel matrix with other asci and paraphyses. ASCOSPORES mostly biseriate, broad-lunate to lunate, sometimes sublacrymiform, (4.1–) 4.4–5.1 (–5.9) x (1.1–) 1.5–1.9 µm, hyaline. PARAPHYSES very difficult to discern, slightly enlarged above, unbranched, in a gel.



O. lunata, ascus and paraphysis, hymenial gel shown stippled (CUP-MM 247), ascus and 6 ascospores (CUP-MM 92), 3 basal moniliform hyphae (CUP-MM 247), all x1000.

HOLOTYPE: Canary Islands, Tenerife, on very decayed wood, Cruz del Carmen, Monte de las Mercedes, leg. R. P. Korf, W. C. Denison, L. M. Kohn, & M. A. Sherwood, 7. i. 1976, CUP-MM 247.

KNOWN MACARONESIAN DISTRIBUTION

CANARY ISLANDS

Tenerife. CUP-MM 92 (paratype), 241 (paratype), 247 (holotype).

SUBSTRATA:

On wood, on rotted wood, on very decayed wood.

Notes: This tiny and easily overlooked species appears to have a diagnostic spore shape, unlike any other in the genus that I have encountered in my literature and specimen survey.

7. **Orbilia luteorubella** (Nyl.) P. Karst., Bidrag Kännedom Finlands Natur Folk **19:** 101. 1871.

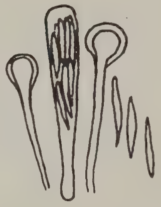
RECENT TAXONOMIC TREATMENTS:
Svrček (1954), Dennis (1960, 1968, 1978), Spooner (1987).

PREVIOUS MACARONESIAN RECORDS:
None.

TYPE LOCALITY:
Alavo, Finland.

KNOWN MACARONESIAN DISTRIBUTION
MADEIRA.
Madeira. CUP-MM 2287, 2307, 2435.
CANARY ISLANDS.
Tenerife. CUP-MM 592.

SUBSTRATUM:
On wood.



O. luteorubella, paraphysis (CUP-MM 2435), ascus and paraphysis (CUP-MM 2287), 3 ascospores (CUP-MM 2435), all x1000.

8. **Orbilia occulta** (Rehm) Sacc., Syll. Fung. **8:** 623. 1889.

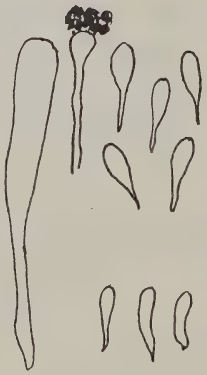
RECENT TAXONOMIC TREATMENTS:
Svrček (1954).

PREVIOUS MACARONESIAN RECORDS:
None.

TYPE LOCALITY:
Newfield, New Jersey, USA.

KNOWN MACARONESIAN DISTRIBUTION
CANARY ISLANDS.
Gomera. CUP-MM 2627 (TFC).
Tenerife. CUP-MM 2555 (UPS), 2694 (TFC), 2735 (TFC).

SUBSTRATUM:
On and inside hollow stems of *Euphorbia canariense* and *Euphorbia* sp.



O. occulta, ascus, paraphysis, 5 ascospores (above CUP-MM 2555), 3 lower ascospores (CUP-MM 2694), all x1000.

MYCOTAXON

Volume XLIV, pp. 511-516 October-December 1992

BOOK REVIEWS

L. M. Kohn, Book Review Editor

Fungorum Rariorum Icones Coloratae XIX: Inocybes critiquables et critiqués, by Pierre Moënne-Loccoz, Jacques Poirier et Patrick Reumaux. Softcover, 245x170 mm, 55 pp., 1990. J. Cramer, Gebr. Borntraeger Verlagsbuchhandlung, Johannesstr. 3 A, D-7000 Stuttgart 1, Germany. ISBN 3-443-69005-X. DM 58.--.

The series **Fungorum rariorum icones coloratae** was initiated by Dr. D. A. Reid of Kew Herbarium and has appeared iregularly since 1966. Each issue contains 8 plates of watercolours supplemented with descriptions and line drawings. The present issue represents the second in the series by Moënne-Loccoz and Reumaux and includes a third author, Jacques Poirier. This is a collaborative effort in which the authors maintain their individuality throughout. Under each species is a description of the macroscopic features of fresh basidiomata followed by a description of microscopic characteristics. Following these are observations and discussions. The author of each of these sections is identified. All of the authors have contributed collections, macro- and microscopic descriptions and discussions. The authors appear to have shared their material while working independently on their contributions. Some species have observations and discussions made by more than one author: these are kept separate from one another and may contain cross references. While this may sound rather disorganized it is, in fact, an attractive feature of the issue. The illustrations are excellent and appear to have been done by one person. The line drawings, done at two magnifications are sometimes a little shakey but illustrate a large number of structures from each collection. Although I was unable to discover which of the authors did them, the lovely watercolours resemble those of Moënne-Loccoz in the **Atlas Des Cortinaires** (Éd. Féd. Mycol. Dauphiné-Savoie, 1990-1991). The taxonomic treatment is rigourous and refers frequently to other publications. I was pleased with their treatment of *I. sororia* Kauffman and their attempt to reconcile both American and European concepts. Their discussion of the differences between *I. grammata* Quélet and *I albodisca* Peck included a description of the holotype of the latter. In my opinion this is the first convincing argument that the two species are distinct.

This is an excellent little publication that will appeal to people interested in *Inocybe*. There are far too few species to make this useful as an identification guide and thus the occasional collector of mushrooms will not have a great need for it. It is an important contribution to *Incocybe* systematics and should certainly be in any library with a collection in agaricology. *D. W. Malloch, Dept. of Botany, Univ. of Toronto. Ontario, Canada M5S 3B2.*

Arctic and Alpine Fungi - 4, by T. Schumacher and K.-M. Jenssen. Softcover, 240x167 mm, 66 pp, 1992. Soppkonsulenten A/S, Lyngveien 3, N-1430 Ås, Norway. ISBN 82-991301-3-1. NOK 200.--.

This, the fourth volume in a series dedicated to the arctic and alpine mycoflora, treats 25 species of discomycetes known from the Dovre Mountains of Central South Norway, where the first author has collected for many years. This is a region with a cold, continental climate, predominantly calcareous, alkaline soils and a variety of vegetation types known in other alpine and arctic regions. In selecting 25 species from the 102 operculate and 10 soil-inhabiting inoperculate species identified to date from this region, the authors have sought to treat only the true alpine or arctic-alpine species, many of which have been reported from other areas including Europe, Fennoscandia, Greenland, and the Svalbard archipelago. Operculate species represent the genera *Helvella*, *Boudiera*, *Peziza*, *Cheilymenia*, *Geopora, Iodophanus, Lamprospora*, *Marceleina*, *Octospora*, *Parascutellinia*, and *Scutellinia*. Inoperculate species represent *Ciboria, Ciborinia, Myriosclerotinia,* and *Bryoglossum*.. Each entry is accompanied by descriptions of anatomy and morphology, habitat and distribution, and nomenclature (including synonyms and misapplied names). Of special note are the excellent color habit photographs and line-drawings of apothecial microanatomy that accompany each entry. Although scanning electron micrographs of ascospores are provided for operculate taxa, the line drawings of ascospores and paraphyses are a bit crude since they are incorporated in the line drawings of a cross section of the apothecium and not treated alone, at a more appropriate magnification. Also, I prefer scale bars rather than magnification in such illustrations. Voucher specimens are not cited, although the careful citation of relevant literature will allow readers to locate representative herbarium material. Despite these very minor criticisms, this manual will allow conclusive identification of any of the discomycete species included here. Would that we had such excellent resources for many more discomycetes; this work joins Breitenbach and Kränzlin's *Fungi of Switzerland* and the Schmid's *Ascomyceten im Bild* in setting a high standard for floristic treatments of discomycetes. This book should be of great interest to discomycetologists and arctic/alpine mycologists and their students. Note that the first three volumes treat selected agarics following the same format and are available individually from the same publisher at NOK 125., 210., and 200., respectively; all four volumes can be ordered together at the special price of NOK 600. Although each volume is bound in plastic, the whole set could be perforated and inserted in a loose-leaf binder.
L. M. K.

Handbook of Applied Mycology, Vol. 1, Soil and Plants, Eds. D. K. Arora, B. Rai, K. G. Mukerji, G. R. Knudsen (720 pp., ISBN 0-8247-8380-8, 1991); **Vol. 2, Humans, Animals, and Insects**, Eds. D. K. Arora, L. Ajello, K. G. Mukerji (783 pp., ISBN 0-8247-8435-9, 1991); **Vol. 3, Foods and Feeds**, Eds. D. K. Arora, K. G. Mukerji, E. H. Marth (621 pp., ISBN 0-8247-8491-X, 1991); **Vol. 4, Fungal Biotechnology**, Eds. D. K. Arora, R. P. Elander, K. G. Mukerji (1114 pp., ISBN 0-8247-8501-0, 1992); **Vol. 5, Mycotoxins in Ecological Systems**, Eds. D. Bhatnagar, E. B. Lillehoj, D. K. Arora (443 pp, ISBN 0-8247-8551-7, 1992). Marcel Dekker, Inc., 270 Madison Ave., New York, NY 10016 (tel. 212-696-9000). Each volume $150.--.

This is a giant compilation of contributions on many facets of applied Mycology, including agricultural, industrial, pharmacological, medical, and food science applications. By its sheer size and scope, with contributions from a truly international roster of scientists, these volumes earn a place in any university or industrial library serving microbiologists, mycologists (medical and general), pharmacologists, plant pathologists, and engineers interested in fermentation, pulping, and other industrial applications of biotechnology. Individual scientists, probably deterred by the cost of buying all five volumes, will prefer to peruse these volumes to determine whether one or more are indispensable additions to a personal library. Volume 1 includes the following subheadings: Mycorrhizal and Endophytic fungi (9 chapters), Biological Control (5 chapters), Fungal Degredation Processes (5 chapters), and Modeling and Quantitative Approaches (5 chapters). Volume 2, with chapters not grouped under subheadings, surveys an assortment of topics in medical mycology, fungal taxonomy, identification of pathogens, ontogeny, genetics, as well as pathogenesis of invertebrates and fish. Among the topics treated in Volume 3 are the taxonomy, ecology, spoilage and mycotoxin production of filamentous fungi in foods and feeds, xerophilic fungi in foods with intermediate and low moisture, fungi in grains, vegetables, and processed fruits, cultivated mushrooms, fermented foods, fungal enzymes in food processing, antifungal food additives, and uses and products of yeast and yeastlike fungi. Volume 4 includes chapters under the subheadings, Molecular Technologies (10 chapters), Commercial Applications (17 chapters), Decomposition of Biological and Chemical Waste (4 chapters), and Culture Collections, Legal Aspects, and Biosafety (3 chapters). Volume 5 treats topics including aflatoxins and other mycotoxins, strain instability in filamentous fungi, and genetics, biosynthesis, and regulation of some *Fusarium* secondary metabolites. Each volume has its own index. Chapters of particular interest to MYCOTAXON readers will include "Experimental fungal taxonomy" (De Hoog et al., Vol. 2), "Exoantigens in the identification of medically important fungi (Sekhon and Padhye, Vol. 2), "Taxonomy of filamentous fungi in foods and feeds" (Samson et al., Vol. 3), "Molecular methods for identification and taxonomy of filamentous fungi" (Klich and Mullaney, Vol. 4), "Isozyme analysis in fungal taxonomy and molecular genetics" (Micales et. al, Vol. 4), and "Current status of fungal culture collections and their role in biotechnology" (Jong and Birmingham, Vol. 4). I have two major criticisms of these volumes and they both concern the apparent gestation time between preparation of chapters and publication. First, given the rapid development of molecular techniques, book chapters stressing techniques are always obsolete by the time they are published, and those chapters with molecular techniques as their *raison d'être* in this compilation are no exception. If the data are good, they are interesting forever, not so the techniques. Second, be forewarned that references stop mainly around 1989, with only Vols. 4 and 5 including some 1990 references. Due to both the selection of several chapter topics in four of the volumes stressing "novel" applications of molecular techniques and the apparent lag in publication, we have some anomalies such as reviews of molecular systematics that do not consider the uses of the polymerase chain reaction and that hold out DNA sequencing as a distant possibility, as well as discussions of electrophoretic karyotyping unsupported by critical recent literature. Breaking events in science, unlike fine wines, should be served while young and fresh. *L. M. K.*

Botanico-Periodicum-Huntianum/Supplementum, compiled and edited by G. D. R. Bridson, assisted by E. R. Smith. Hardcover, 285x222 mm, 1068 pp, 1991. Hunt Institute for Botanical Documentation, Carnegie Mellon University, Pittsburg, PA 15213-3890, U.S. A. (tel. 412-268-2434, credit card orders accepted). ISBN 0-913196-54-1. $95.-- prepaid plus postage and handling (domestic $6.--, plus $2.-- for each additional book; foreign $9.-- uninsured, $25.-- insured).

This is a supplement and partial revision of **B-P-H Botanico-Periodicum-Huntianum** published by the Hunt Institute in 1968. **B-P-H** is not superceded by the new volume, but rather the new volume offers references to the ca. 12,000 titles in the old volume, while increasing the total number of entries to over 25,000 up to the end of 1990 with a few additional titles from 1991. For those unfamiliar with the 1968 volume, both volumes offer a title catalogue of "all periodical (serial) publications that regularly contain (or, in some period of their history, included) articles dealing with the plant sciences and botanical literature." The entries are listed alphabetically by full title. Every entry in **B-P-H** determined by the compilers to "remain valid" (I am not sure what this means), is cross-referenced in **B-P-H/S** with a citation of the relevant **B-P-H** page and entry number. Cross-references are more complete in the new volume and include citation abbreviations. There are at least four reasons why these volumes are absolutely essential to systematic mycologists and the libraries that serve them. First, the two volumes in combination provide a history of the names of serials through "marriages, divorces and deaths", as one supercedes another, e.g., Mycological Research superceding Transactions of the British Mycological Society. Second, the two volumes allow one to unravel the mysteries of the incomplete, incorrect, or simply bizarre abbreviations of serial titles so often encountered in bibliographies. Third, **B-P-H/S** provides standard abbreviations of most serial titles encountered, including newer serials in the areas of molecular biology and systematics; the Instructions to Authors for the journal, Mycologia stipulate that the **B-P-H** abbreviations be used and certainly this standard reference is useful in preparing manuscripts for any journal. Fourth, the saturation of foreign titles in these volumes is unparalleled in my experience. Does one need both volumes? For the purposes of investigative bibliographic research, yes; for abbreviations of serial titles, **B-P-H/S** will probably suffice. Note that about 180 copies of the 1968 **B-P-H** are still available from the Hunt Institute ($20.-- prepaid plus postage and handling - domestic $3.--, foreign $9.--). As expected, **B-P-H/S** is on a computer data base that will presumably be revised periodically; my copy came with corrigenda on two additional unbound pages. *L. M. K.*

The Fifth Kingdom, Second Edition, by Bryce Kendrick. Softcover, 230x153 , 406 pp, 1992. Mycologue Publications. ISBN 0-941051-28-5. Canadian Sales, Mycologue Publications, 331 Daleview Place, Waterloo, Ontario, Canada N2L 5M5 (tel. 519-885-1211, ext. 2561); U.S. Sales, Focus Texts, Focus Information Group, Inc., PO Box 369, Newburyport, MA 01950 (tel. 617-734-9407). $30.-- U.S. & Canadian.

This is the revised second edition of the text first published in 1985. After using every Mycology text published in North America, including the first edition of **The Fifth Kingdom**, in my second and third year undergraduate Mycology courses during the last twelve years, **The Fifth Kingdom 2nd Ed.** is clearly the sportiest, most engaging, most comprehensive and current, and most reasonably priced text on the market. The format is essentially that of the first edition, with seven chapters covering comparative morphology and life cycles [Kingdoms and Classification, Protoctistan Fungi..., Eumycotan Fungi - Zygomycota, Dikaryomycota (two chapters), Yeasts: Polyphyletic Fungi, and Lichens:Dual Organisms], followed by 16 chapters on Fungal Physiology, Genetics, Ecology, and more specific topics such as Plant Pathology, Biological Control, predation, mutualism (two chapters), Mycophagy, Food Processing, Food Spoilage, Mycotoxins, Poisonous Mushrooms, and Medical Mycology, plus an extensive Glossary. The chapters on morphology and life cycles have been improved in the second edition with thorough labelling of drawings and more life cycle diagrams. As in current Biology texts, 'Slime Moulds' (not included in the 1985 edition), the Hyphochytridiomycota and the Oomycota are included in the 'Protoctista and Protoctistan Others' , as are the Chytridiomycota. The treatment of the Ascomycotina is unusual, commencing with a general discussion of teleomorphs, then a more detailed discussion of anamorph morphology and conidiogenesis, followed by a survey of ascomycetous holomorphs . The survey of holomorphs is arranged under Orders which are grouped under ascus type, e.g., Unitunicatae-Operculatae. A dichotomous key to 17 Orders of ascomycetes is provided. The treatment of the Basidiomycotina is more conventional, taking up Orders under the Holobasidiomycetes, Phragmobasidiomycetes and Teliomycetes; a fill-in-the-blank form for describing characteristics of agarics that could be photocopied, as well as a key to some common Orders of basidiomycetes is provided. I admire the treatment of yeasts as a polyphletic grouping in both editions. If I have any criticisms, they come from my students and apply to both editions. First, the dual use of Phyla and Divisions in Chapter 2 is confusing when one looks at the fungal taxonomic hierarchy on page 6 of Chapter 1. Second, the brief survey treatment of so many orders of Ascomycotina and the details on conidiogenesis are somehow too much and too little for neophyte students. Of course this can be compensated for with the right emphasis in lectures and with some reasuring words to students about gaining perspective on diversity without having to memorize too many Latin names. The genetics chapter is greatly expanded to include both classical and molecular aspects as well as applications in systematics and biotechnology. As with other Mycology texts, I wish that distinctions between sexes and mating types were made more clearly and that heterothallism and homothallism were defined on the basis of whether one nucleus and its mitotic progeny are or are not capable of undergoing sexual reproduction, rather than on the basis of whether one mycelium is or is not capable of sexual reproduction (clearly not applicable to yeasts, secondary homothallics, and fungi that mate immediately after meiosis). Most chapters have been noticably revised, particularly those on Mycotoxins , Fungi as Food, and the Medical Mycology chapter. The glossary compares favorably in scope with that of other Mycology texts. My overall impression is that while the revised text retains the singular Kendrickian flare of the first edition, it is a more serious and comprehensive treatment. In provocatively conveying the multitude of ways that fungi impact the ecosystem and particularly, human affairs, this text has no equal as an introduction to Mycology. *L. M. K.*

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NOTICE

FIRST INTERNATIONAL WORKSHOP ON ASCOMYCETE SYSTEMATICS

PROBLEMS AND PERSPECTIVES IN THE NINETIES

A NATO ADVANCED RESEARCH WORKSHOP

co-sponsored by the:

International Mycological Association
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PARIS, FRANCE 11-14 MAY 1993

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A *Provisional Programme* is now available.
The number of participants will be limited, and you are therefore urged to indicate your interest promptly.

To receive a copy of the first and subsequent circulars, please contact:

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The Editors express their appreciation to the following individuals who have, prior to acceptance for publication, reviewed one or more of the papers appearing in this volume:

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